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STATISTICAL REVIEW

Annual Market Study of the
Telecommunications Equipment Industry
by
North American Telecommunications Association

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SCOPE AND METHOD

The *1986 NATA Telecommunications Equipment Industry Statistical Review* provides a comprehensive, current overview of the business-telephone equipment market in the United States. The findings in the *NATA Statistical Review* come from the best data available and are grounded in assumptions reflecting trends and developments as reported by a wide range of industry sources. The market analysis rests on quantitative estimates of the following data:

- Manufacturers' annual shipments of PBX and key telephone equipment, measured both in equipment volume and revenues.
- Vendors' sales of new equipment to end users, measured in both equipment volume and revenues.
- Vendors' installed base of equipment, referring to the cumulative total of telephone equipment in use on customers' premises.

NATA's research department has spent the better part of the year collecting and analyzing primary data and reviewing all recent projections. NATA's primary source for this study has been an extensive formal survey of industry participants to identify and track current trends and projections. NATA researchers also have reviewed a wide range of industry studies and consulted many independent analysts to ensure that no significant aspects of the industry have been overlooked. Though these sources have been extremely helpful, the data and assumptions in this *NATA Statistical Review* are entirely those of NATA.

David Keeler
Manager, Market Research
October 1986

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EXECUTIVE SUMMARY

Industry Overview

The business-telephone-equipment industry in 1986 has begun to put the turmoil of the previous three years behind and settle into a more stable period of growth and development. By some critical indicators 1986, though not a banner year by any measure for telephone-equipment manufacturers and vendors, marks a return to the more predictable market conditions characteristic of the era prior to the AT&T divestiture decree and the Federal Communications Commission (FCC) *Computer II* order deregulating the Bell System's provision of customer-premise phone gear. Throughout the remainder of the decade, preliminary 1986 data suggest, industry shipments and sales of key, hybrid key, and private branch exchange (PBX) telephone systems should grow at a steady, though moderate, rate—in sharp contrast to the boom-and-bust cycle that characterized the equipment market in the years 1983–1985. In addition, manufacturers' and vendors' prices and profits have begun to show signs of firming up after falling precipitously in those fiercely competitive years. Most important, as manufacturers, vendors, and consumers grow more familiar with the postdivestiture, postderegulation landscape, the rampant confusion that once plagued the industry is giving way to a fresh appreciation of opportunities in the new marketplace.

The year 1985 represents a watershed in the development of competition in telephone-equipment sales and service. For independent vendors of phone gear—"interconnects"—the explosive growth in sales and profits that accompanied the prior two years' disjointed implementation of divestiture and deregulation had, by 1985, clearly played itself out. Industrywide sales of PBX and key/hybrid systems in 1985 failed to sustain the strong growth levels of the year before, while prices and profits continued to fall. All across the industry, vendors—AT&T and the divested Bell companies (BOCs)* among them—cut costs significantly to capture or retain market share. The long-expected shakeout of marginal vendors began in earnest, with the pace of business failures, mergers, and outright acquisitions accelerating over the course of the year. As 1985 ended, a leaner, more competitive telephone-equipment industry was rapidly emerging.

This consolidation among equipment makers and vendors is one of the two most significant long-term results of deregulation, divestiture, and their aftermath. The other is a shift in distribution patterns that favors AT&T and the BOCs. This process of consolidation, illustrated most dramatically by ITT's selloff of telecom businesses to a joint venture with Alcatel's French parent, is expected to continue at least through 1987—with competitive pressures forcing smaller independent manufacturers and vendors to sell out, merge with better-capitalized concerns, or leave the market altogether.

The concurrent shift in distribution toward AT&T and the BOCs, a phenomenon noted in the 1985 *NATA Statistical Review*, stems from aggressive efforts by those companies to regain much of the Bell System's historical dominance in the business phone-gear market. AT&T has halted the erosion in market share it experienced in the early 1980s and should steadily increase its presence through the end of the decade. The BOCs, which entered the postdivestiture world in 1984 with no installed base of equipment customers or distribution team, have returned quickly, mostly through aggressive price competition. AT&T and the BOCs, which collectively accounted for 38 percent of industry sales of business-telephone equipment in 1985, will increase their combined share to over 55 percent by 1990.

Interconnects are moving quickly to adapt to this shifting market, strengthening areas in which they were weak and developing fresh new strategies for growth. One area in which 1985's profit-crisis left interconnects markedly stronger is overall business management, especially improved cost controls. In addition, vendors now position themselves in their local markets with expanded service offerings and broadened technological expertise, no longer competing solely on the basis of price. Moreover, independent vendors, in keeping with their entrepreneurial origins, have been ranging into new voice- and data-communications product lines, try-

*For the convenience of the reader, the acronym "BOC" is used in this study to refer generically to all Bell companies, including regional holding companies, individual Bell operating companies, and equipment-sales subsidiaries—both those administered by a Bell regional holding company and those administered by individual Bell operating companies.

ing out new sales and marketing techniques, and joining into strategic alliances and cooperative ventures with manufacturers and other vendors.

These steps should enable many interconnects to rise to the challenges of the evolving telephone-equipment market in the late 1980s and help vendors lay the foundation for continued growth and prosperity.

Summary of NATA Findings

Product Markets

Key and Hybrid Systems

Sales of key and hybrid telephone systems will rebound somewhat in 1986 over 1985's dismal performance, though growth is expected to remain modest through 1990. Sales growth will be highest in the market for very small key systems, as small businesses replace older equipment and take advantage of sophisticated features available with new electronic systems. For the key/hybrid market, 1985 represented the worst year in recent history, a year in which the overcrowding and overproduction of the prior year contributed to diminished sales volumes and profit margins for many manufacturers and vendors.

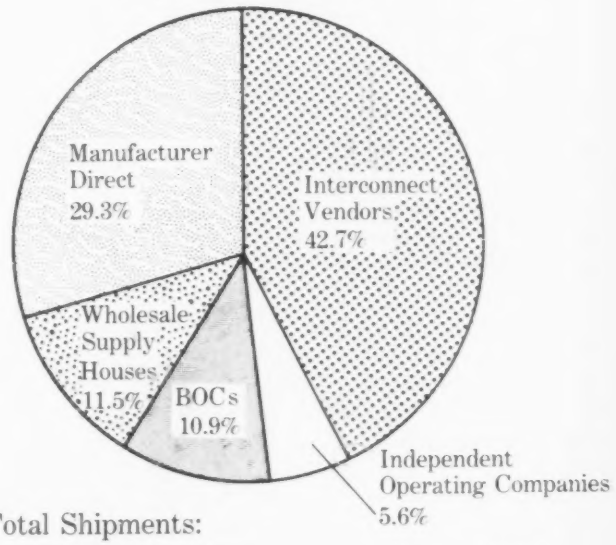
Projections

- Manufacturers' annual shipments of key and hybrid stations will equal 4.2 million stations in 1986 and will grow to just under 4.5 million stations by 1990, representing a compound annual growth rate (CAGR)* from 1985 to 1990 of 1.5 percent. However, annual shipments of systems will grow to 520,160 over the same period, at the somewhat higher 2.6 percent CAGR, indicating a marginal decrease in average number of stations per system shipped.
- Manufacturers' annual revenues from shipments of key and hybrid equipment will total $965 million in 1986 and will rise to $1,049 million by 1990, growing at a 1.9 percent CAGR from 1985's figure.
- Vendors' annual revenues from sales of key and hybrid systems to users will be $2,098 million in 1986, and will increase to almost $2,300 million by 1990, rising at a 2.3 percent CAGR from the 1985 level.
- The installed base of key and hybrid stations (including instruments attached to systems either standing alone or serving as adjuncts to PBX or Centrex switches) will grow at a 3.4 percent CAGR from 1985 to 1990. The stand-alone portion of this base will grow at a 4.9 percent CAGR over the same period.

1985 Performance

- Manufacturers' annual shipments of key and hybrid equipment fell to 4.15 million stations in 1985—down 2.1 percent from 1984 levels—and to 457,600 systems, down 1.8 percent from the year before.
- Manufacturers' annual revenues from shipments of key and hybrid equipment dropped to $955 million

KEY & HYBRID SHIPMENTS BY MANUFACTURERS' DISTRIBUTION CHANNEL: 1985

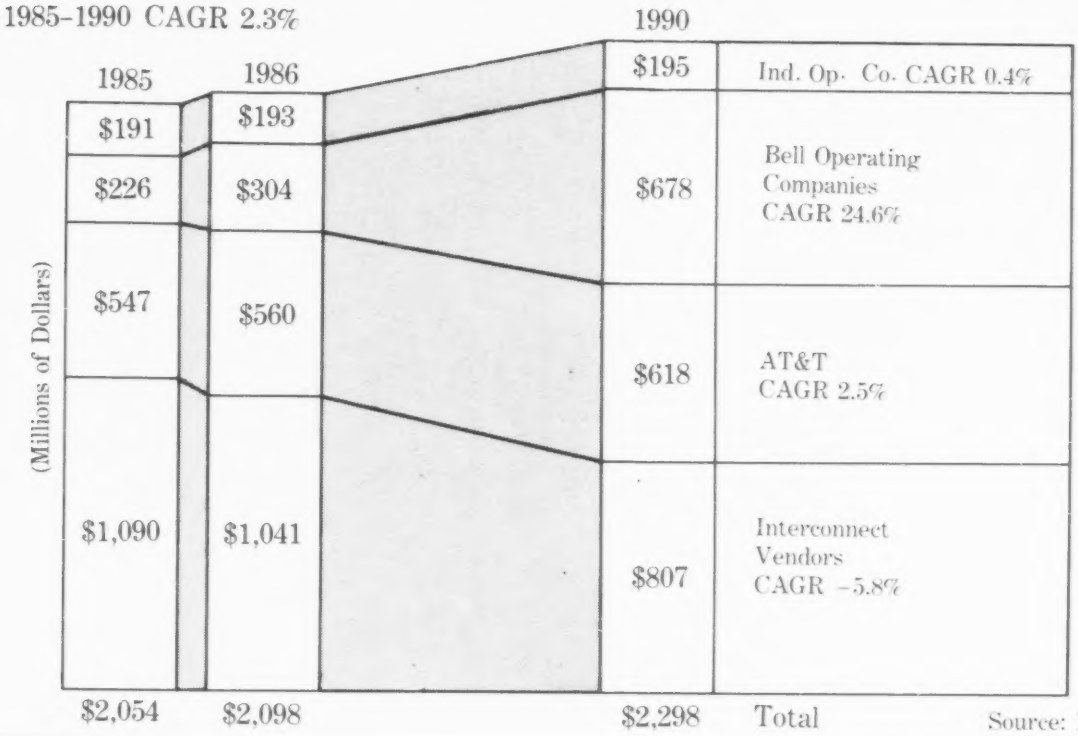


Total Shipments: 4,150,000 Stations

Source: NATA

*CAGRs in the narrative of this study can be assumed to refer to rates calculated between the years 1985 and 1990, unless otherwise noted. The rates in the tables are given separately for the years 1981 through 1985 and the years 1986 through 1990.

KEY & HYBRID SALES TO END USERS BY VENDOR CATEGORY



Source: NATA

in 1985, an 8.1 percent decline from the previous year.

- Vendors' annual revenues from sales of key and hybrid systems to end users amounted to an estimated $2,054 million in 1985, down almost 12 percent from 1984's level.

- The installed base of key and hybrid stations (including instruments attached to systems either standing alone or serving as adjuncts to PBX or Centrex switches) grew to 28.2 million in 1985, up 2.0 percent from the year before. The stand-alone portion of this base grew to 18.8 million stations in 1985, up 3.9 percent from the level in 1984.

PBX and Centrex Systems

Sales of PBX systems will rise moderately throughout the remainder of the decade. PBX sales growth will be greatest in the very large system-sizes, as users upgrade outmoded PBXs and continue replacing very large Centrex installations. PBXs will see continued competition in the low end of the market from both Centrex and hybrid key systems, and in the high end from Centrex starting around 1988. In contrast to the market for key and hybrid systems, sales of PBXs grew at a healthy rate in 1985, though not at as strong a pace as the year before.

Projections

- Manufacturers' annual shipments of PBX equipment will equal 4.3 million stations in 1986 and will grow to 5.4 million stations in 1990—rising at a 5.5 percent CAGR from 1985—and to 35,200 systems in 1990, increasing at a 5.6 percent CAGR over the same period.

- Manufacturers' annual revenues from shipments of PBX equipment will increase to $1,696 million by 1990, rising at a 6.9 percent CAGR between 1985 and 1990.

- Vendors' annual revenues from sales of PBX equipment to end users will be $3,147 million in 1986 and

will grow to $4,146 million by 1990, rising at a 6.8 percent CAGR between 1985 and 1990.

- The aggregate installed base of PBX and Centrex stations will grow to 41.1 million by 1990, rising at a 5.7 percent CAGR from 1985 figures. The PBX portion of this base will grow to 31.8 million stations by 1990, rising at a 6.5 percent CAGR over the same period.

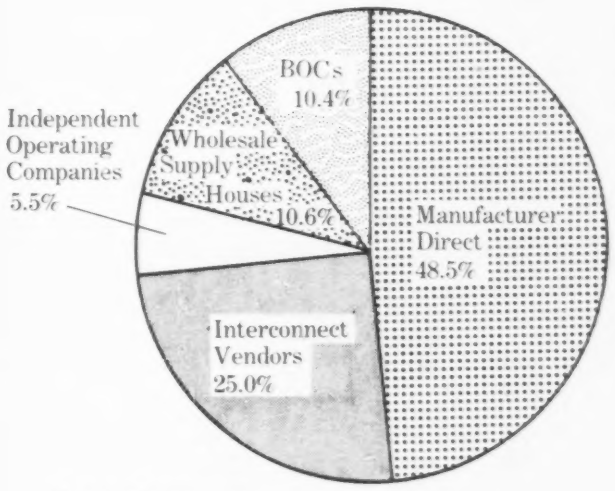
1985 Performance

- Manufacturers' annual shipments of PBX equipment grew to 4.1 million stations in 1985—amounting to an 8.6 percent rise over 1984—and to 26,830 systems, a 2.6 percent jump over the previous year.

- Manufacturers' annual revenues from shipments of PBX equipment grew to $1,214 million in 1985, a 3.3 percent rise over the 1984 level.

- Vendors' annual revenues from sales of PBXs to end users grew to $2,983 million in 1985, a 1.6 percent increase from the previous year.

PBX SHIPMENTS BY MANUFACTURERS' DISTRIBUTION CHANNEL: 1985



Total Shipments:
4,115,000 Stations

Source: NATA

- The aggregate installed base of PBX and Centrex stations grew to 31.1 million in 1985, showing a 4.5 percent rise over the year before. The PBX portion of this base grew to 23.2 million stations in 1985, representing a 5.7 percent increase over 1984's figure.

Distribution Channels

Interconnects

As a group, independent vendors will account for a declining share of annual industrywide telephone-equipment sales, as the current round of market consolidation continues at least through 1987. Interconnects' actual revenues, however, will remain stable through 1990, the result of two factors. First, many individual interconnect firms will realize higher sales volumes and improved profit margins in this more concentrated market. Growth for these interconnects will come largely through improved management, innovative sales and marketing approaches, and broadened product lines. Second, many vendors will increase significantly the portion of their revenues from postsales activities, such as maintenance, moves-and-changes, and upgrades, with revenues from postsales activities offsetting relative declines from equipment sales.

Projections

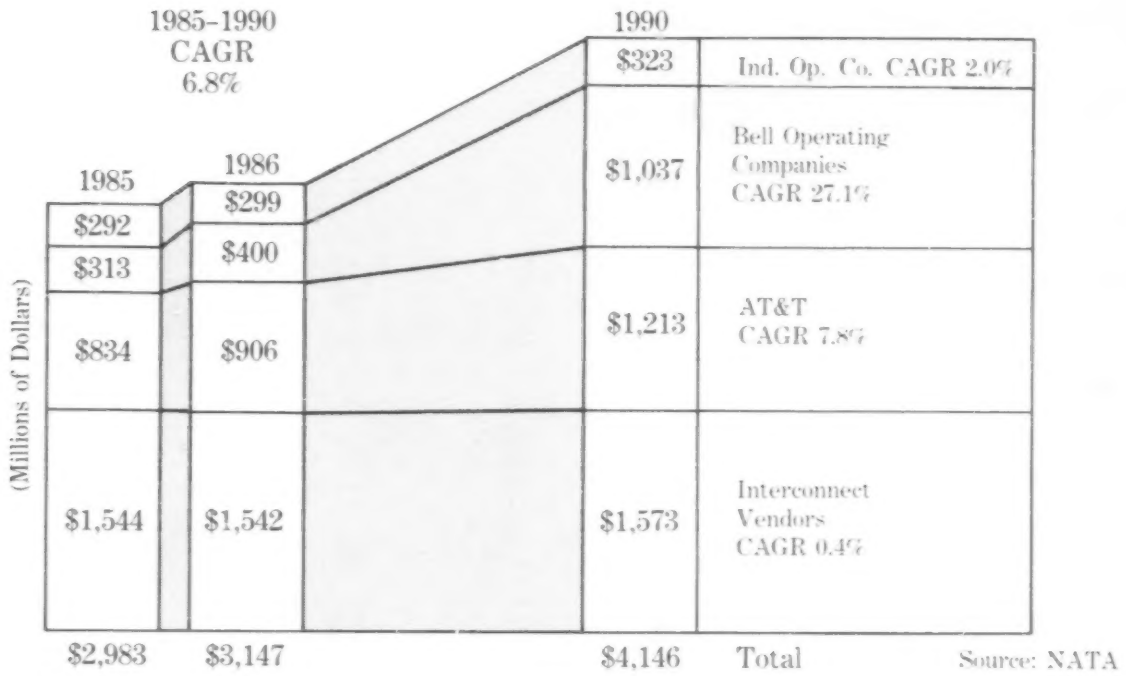
- Interconnect industry annual revenues overall will be $3,974 million in 1986 and will grow to $4,111 million by 1990, increasing at only a 0.9 percent CAGR from 1985.

- Interconnect industry annual revenues from sales of new PBX, key, and hybrid telephone systems, amounting to $2,583 million in 1986, will fall to $2,380 million by 1990, declining at about a 2 percent CAGR between 1985 and 1990.

- Interconnect industry share of total telephone-equipment industry annual sales of PBX, key, and hybrid telephone systems will decline from 52 percent in 1985 to 37 percent in 1990.

- Interconnect industry annual revenues from postsales activities (such as maintenance, moves-and-changes, and upgrades) as a percentage of total in-

PBX SALES TO END USERS BY VENDOR CATEGORY



Source: NATA

terconnect industry annual revenues will increase from 33 percent in 1985 to 42 percent in 1990.

1985 Performance

- Interconnect industry annual revenues fell to $3,931 million in 1985, a 5.9 percent decline from the 1984 level.
- Interconnect industry annual revenues from sales of new PBX, key, and hybrid telephone systems fell to $2,634 million in 1985, an 11 percent decline from the previous year.
- Interconnect industry annual revenues from post-sales activities climbed to $1,297 million in 1985, a 6.4 percent rise from the previous year.

AT&T

- AT&T, despite heavy losses and an eroding rental installed-base in its telephone-equipment operations, will see improvement in its share of annual PBX and key equipment sales to end users, a share that will rise from 27.3 percent in 1985 to 28.2 percent in 1990.

Bell Operating Companies

- The BOCs will continue to show dramatic growth in annual PBX and key equipment sales to end users, jumping from 10.8 percent of new sales in 1985 to 27 percent by 1990.

Independent Telephone Operating Companies

- The independent telephone operating companies' share of annual equipment sales to end users will drop from 9.5 percent in 1985 to about 8.1 percent in 1990.

Regulatory Developments

Federal regulators in 1985-86 continue to exert considerable influence over the future development of the telephone-equipment industry.

In March 1986, the FCC proposed lifting its current requirement that the BOCs market telephone equipment through subsidiaries structurally separated from their monopoly telco operations. This separate-subsidiary concept, at the heart of the FCC's 1980 *Computer Inquiry II* plan, was designed to protect rate-

payers and competitors alike. As conceived in 1980, the separate subsidiary was to impede monopoly phone companies from using their control of bottleneck communications facilities to bankroll and prefer their own competitive offerings.

In proposing to lift this separate-subsidiary requirement for BOCs, however, the FCC indicates it currently accepts the BOCs' argument that they, like AT&T, are put at a competitive disadvantage by having to maintain costly, and unnecessary, duplication of overhead for separate subsidiaries. In September 1985 the FCC had already acceded to this argument for the BOCs' former parent, AT&T, granting that firm permission to merge its unregulated equipment and regulated network-service sales forces. Moreover, the FCC in its 1986 *Computer Inquiry III* ruling extended this argument to the area of enhanced services. In the *Computer III* ruling, the commission decided to eliminate the requirement that the BOCs and AT&T maintain separate subsidiaries for the marketing of unregulated enhanced services, such as voice mail, on-line data-bases, and data processing. (The FCC decision notwithstanding, many of these enhanced services cannot be provided by the BOCs unless the divestiture decree's prohibition on these companies' provision of "information services" is substantially modified. In addition, AT&T is not allowed to offer some enhanced services without a lifting of the divestiture decree's prohibition against that firm's provision of "electronic publishing.")

In place of structural separations, the FCC proposes substituting nonstructural safeguards such as those already imposed on AT&T. The commission maintains that these mechanisms—accounting rules and reporting procedures—can guard against cross subsidies and ensure that equipment competitors receive both nondiscriminatory access to network facilities and early warning about changes to the network.

One element of the FCC's proposal to lift structural separations for equipment sales has been called into question by a recent Supreme Court decision. As originally formulated, the FCC proposal indicated the commission's intention to bar state regulators from imposing their own separate-subsidiary requirements. However, the FCC's authority to preempt state regulators was undercut by a June 1986 U.S. Supreme Court ruling that invalidated the commission's effort to preempt state authority over telcos in another area, that of intrastate depreciation.

Separately, the FCC took two actions favorable to independent phone-equipment vendors. First, the commission in November 1985 told Bell regional holding companies Ameritech and NYNEX to revise their network-services sales-agency programs following NATA's charges that the equipment subsidiaries of these companies were winning almost 100 percent of sales-agent commissions for selling such services as Centrex. The FCC in July 1984 had given the Bell regionals' equipment sales forces permission to earn commissions for selling their telcos' network services as long as independent vendors were given a "reasonable" chance to participate. In a series of complaints, NATA argued that Ameritech and NYNEX were dragging their heels in signing up independents and were paying a lopsided share of commissions to their own affiliates. In another victory for interconnects, the FCC in October 1985 made Bell Atlantic's waiver to serve as prime contractor for joint sales of Centrex and telephone equipment contingent upon the Bell regional's selection of unaffiliated vendors as subcontractors—without the participation of Bell Atlantic's own equipment affiliate.

Meanwhile, U.S. District Court Judge Harold Greene, who presides over the divestiture agreement, granted the Bell companies waivers from the divestiture judgment, enabling them to diversify into a wide range of businesses. Most notably, Judge Greene granted Ameritech permission to manufacture equipment abroad. Though the waiver limited sales of Ameritech-manufactured equipment to foreign markets, many observers have expressed concern that the judge's approval of the foreign-manufacturing waiver signaled his willingness to permit the BOCs to manufacture equipment for domestic consumption as well.

On Capitol Hill, Senate Majority Leader Robert Dole (R-KS) in June 1986 introduced, with the full backing of the Reagan administration, the strongest of five "free-the-BOCs" bills before Congress in 1985–86—though none of these measures passed into law before Congress adjourned and no lame-duck session appeared likely. The bill, S-2565, would not have lifted outright the divestiture judgment's remaining restrictions on the BOCs but instead would have transferred jurisdiction over the judgment from the U.S. District Court to the FCC. Given recent FCC moves, such a shift would have been tantamount to lifting the remaining restrictions. In their successful opposition to the bill, NATA and several other industry and consumer groups warned legislators that the BOCs could still use their continuing control of local telephone exchanges both to discriminate against equipment-vending competitors and tap ratepayers for the funds needed to get new businesses off the ground.

PRODUCT AND MARKET DEFINITIONS

Key and Hybrid Systems

Product Definition

Key telephone systems are multiline business-communications systems providing users with shared access to a group of external telephone lines through buttons (or "keys") located on the telephone set. Typically, each key is associated with a specific outside line, and that line's number appears on the key. When a user presses a key and lifts the telephone receiver off-hook, a circuit is completed and the user receives dial tone from the telephone company's central office (CO). The buttons on a key telephone generally light up and flash to indicate the status of the line to which the phone is connected. For example, an unlit button indicates an idle line, a slow flash indicates an incoming call, a fast flash indicates a call on hold, and a steady light indicates that the line is in use. This type of network access is referred to as *direct line termination*, as each incoming line is connected directly to a specific key on the telephone set.

There are three generic types of key telephone systems, distinguished by the technologies incorporated. Electromechanical, or 1A2-type, key systems are the oldest variety—having been introduced in the early 1960s—and until recently were the most prevalent. Electromechanical key systems rely on mechanical switches and relays driven by electric current for their operation. This type of key system typically is feature-poor, offering few call-handling features beyond hold and intercom, and is characterized (with some exceptions) by the use of bulky 25-pair cabling to connect station sets with the main service unit.

Electronic key systems, introduced in the mid-1970s, replace the mechanical switches and relays of the electromechanical type with solid-state integrated circuits and microprocessors. Electronic key systems typically are highly featured—often providing a range of call-handling features comparable to PBX systems—and are characterized by the use of "skinny-wire" 2- or 4-pair station cabling, rather than the 25-pair commonly associated with electromechanical systems.

Hybrid key systems are the most recent variety, having been introduced in the late 1970s. The designation "hybrid" has caused considerable confusion among users, because vendors use the term to describe highly featured electronic key systems as well as, in some cases, PBX systems designed for very small line-size applications. In this study, hybrid key systems are defined as those combining the network-access characteristics of both traditional key systems and PBX systems—a definition consistent with the current FCC definition of multifunction telephone systems. Hence, true hybrid systems can provide either the direct-line-terminated, one-button-per-line network access characteristic of key systems, or the "dial 9" type network access characteristic of PBX systems—with some able to provide both types of network access simultaneously to different station sets. The type of network access provided is determined generally by minor hardware or software alterations in the hybrid's service unit.

Hybrids not only incorporate technology intermediate between key and PBX systems but typically fall into an intermediate line-size category as well. Most traditional key systems support from 2 to 40 stations, with hybrid key systems dominating the 40- to 120-station market and PBXs comprising the vast majority of systems capable of handling over 120 stations. Of course, these product line-size distinctions are to some extent arbitrary, with hybrid systems overlapping competing products at either end of the 40- to 120-station range.

Product Applications

Key and hybrid systems are primarily voice-communications systems for use in small- to medium-sized offices—those requiring from 2 to 120 station sets. These systems provide intraoffice communication links (intercom), shared access to the public switched telephone network and long-distance networks, and limited office-automation functions (such as call accounting).

Key and hybrid systems can serve either as stand-alones or as adjuncts to larger PBX systems or Centrex offerings. As a stand-alone the key/hybrid, acting as the primary telecommunications system within a small business or a large-business branch office, is connected directly to the local telephone-company central office. As an adjunct the key/hybrid is installed alongside a PBX or to Centrex lines, providing users with enhanced access to those switching systems' features,

as well as affording greater ease of use than do standard single-line telephone sets.

Competitive Products

Key and hybrid systems face competition from three other products. First, higher-line-size hybrid systems are seeing encroachment from small, digital PBX systems. The prospects for growth at the upper end of the hybrid market will diminish as these new, small-line-size PBXs reach the market.

Second, adjunct-key systems are facing competition from the multibutton feature-phones PBX manufacturers are designing specifically for use with their switches. Adjunct-key systems behind PBXs will disappear from the market as more PBX makers introduce such feature-phones and thereby contribute to the replacement of older PBX systems.

Third, stand-alone key and hybrid systems are competing with Centrex services for virtually the entire 7- to 120-stations-per-system market. Recent inroads by Centrex service into this market have shifted some users away from sophisticated, high-featured key and hybrid systems towards low-tech, 1A2-equivalent adjunct products.

PBX and Centrex Systems

Product Definitions

PBX Systems

Private branch exchanges (PBXs) are multiline business-telephone systems providing users with pooled access to a group of external telephone CO lines. PBX systems provide essentially the same services as a telephone company central office—dial tone, signaling, and call routing—but on a much smaller scale and typically from equipment located on a customer's premises. A PBX often is referred to as a switch because, like a central office, it automatically establishes and routes (or "switches") calls between the various stations on a user's premises or between an on-premises extension and the public switched network. A distinguishing characteristic of PBXs is users' pooled access to outside CO lines. When a user dials "9" (or another designated code) from an extension, the switch automatically seizes an idle outside line from a pool of available CO lines to complete the call.

Modern PBX systems fall into one of two categories, distinguished by the method used to switch calls within the system. Space-division switches rely on a continuous physical contact being maintained between the two endpoints of a communications channel. This physical pathway is supplied either by contact points in a switching matrix or by solid-state semiconductors. Some form of space-division switching is employed in all of the older electromechanical PBX systems as well as in some newer electronic models. Space-division technology can handle both analog and digital signals.

A time-division PBX, by contrast, maintains no continuous physical contact between endpoints of a communications channel. This type of PBX breaks voice signals into discrete subunits and switches the signals through the system in serial "time slots." Though time-division switching can handle both analog and digital signals, virtually all major time-division systems currently on the market are digital (a notable exception is AT&T's discontinued Dimension PBX). In a digital time-division switch, analog voice-signals are converted to digital bit-streams, and bit-streams from several distinct voice-channels are transmitted over the same physical pathway in serial time-slots repeated at regular intervals. Digital time-division PBXs can switch both voice and data signals over the same pathway. Digital time-division integrated-voice-and-data PBXs are expected to largely displace older types of PBXs over the next several years, due to the rapidly growing importance of office data-communications.

Centrex Service

Centrex is the generic name for a subscriber switching-service offered by local telephone companies to business customers. Centrex service provides businesses with PBX-like features and capabilities directly from the central office, rather than through premises-based PBX equipment. That is, Centrex service is provided from the same local switching-center that provides business and residential customers alike with dial tone, local-call routing, and access to long-distance networks. In order to provide Centrex, the local telco dedicates a group of lines and a portion of the CO switch to an individual customer.

Typically, Centrex service consists of three elements: local-exchange access and switching; intercom service; and a package of call-processing features similar to those available from PBX systems. Because Centrex is generally treated as a regulated service, prices usually are set in tariffs approved by state regulators.

Three types of CO switches, distinguished by the technologies they embody, currently provide Centrex service in various parts of the country: electromechanical; stored-program-controlled electronic; and digital.

Electromechanical switches, based on crossbar technology, are the oldest type of CO switch. The Bell companies have largely phased out crossbar switches in areas where Centrex is available, but many independent telcos still use the crossbar variety. Stored-program-controlled electronic switches, especially AT&T's 1A family, are currently the most common vehicle for Centrex. Because their functions are controlled by computer programs, stored-program-controlled switches, larger and faster than the crossbar variety, facilitate feature enhancement through software upgrades. The third, and newest, type of CO switch uses digital switching techniques and possesses sophisticated data-transmission capabilities. The Bell companies have launched an aggressive program to replace virtually all of their existing CO plant with this type of switch, the best known examples of which are AT&T's No. 5 ESS and Northern Telecom's DMS 100.

Prior to the Bell System breakup, Centrex—confined primarily to the very-large-business market (500 stations per system and up)—was declining in the market, the result of a deliberate effort by AT&T. However, the Bell operating companies since divestiture have moved aggressively to rejuvenate Centrex services, promoting Centrex heavily in most urban markets. To increase the service's appeal to small businesses, the BOCs have fought for, and won, deep Centrex rate reductions—as well as enhanced feature offerings and lowered minimum line-size restrictions—from state regulators.

Product Applications

Both PBX systems and Centrex service provide primarily voice communications within medium- to large-sized (roughly 120 stations and greater) offices. PBX and Centrex provide intraoffice communication links (intercom), access to the public switched telephone network and long-distance networks, and extensive office-automation functions (such as call accounting and optimal-route selection).

Large, multilocation businesses employ PBX systems and Centrex services as hubs for their own private, intracorporate networks. Companies build private networks by linking geographically separate office switching systems—either PBX or Centrex—with private lines leased from local and long-distance companies. Private lines are telephone circuits dedicated to the exclusive use of one customer.

Another increasingly popular application for PBX and Centrex customers is shared tenant service (STS). With STS, several businesses in an office building or industrial park share a single large PBX or Centrex installation rather than rely on each business installing its own office communications system. The STS installer-operator (usually either the landlord, a major tenant, or a special vendor) essentially runs its own miniature telephone exchange, furnishing subscribers with access to local and long-distance networks, as well as supplying intercom and other standard PBX-type features.

Competitive Products

PBX systems face two principal competitors in the business switching market. PBXs compete directly with hybrid key systems in the 40- to 120-stations-per-system market segment. However, hybrids—though having done quite well in this market over the past four to five years—likely will lose market share and be replaced largely by small digital PBXs over the remainder of the decade. Increasingly, PBX manufacturers are recognizing this growing market opportunity and introducing downsized digital PBXs designed specifically for small offices. Users' growing call for integrated data-transmission capabilities should give PBXs eventual domination over this market, leaving hybrid systems confined largely to the 15- and 40-stations-per-system market segment. Still, hybrid manufacturers continue responding to small- and medium-sized businesses' demands for sophisticated data and office-automation functions by merging hybrid and PBX technologies.

A more serious competitive threat for PBX systems comes from Centrex services. Renewed growth in Centrex lines since 1983 has cut projected expansion of PBX shipments and sales to half of what was projected prior to the Bell breakup. Moreover, steep state-granted rate reductions for Centrex services have increased competitive price pressure on PBX vendors, narrowing already-thin profit margins even further. Especially troubling for PBX vendors is the fact that telcos can offer Centrex service under bundled-rate packages that often include more favorable rates for network access and certain other types of service (such as foreign-exchange lines) than are available to PBX users.

In competition with PBXs, Centrex service boasts such advantages as possible absence of up-front capital

costs to users, flexibility in increasing line-size, and system maintenance at the telephone company's central office. Comparative disadvantages associated with Centrex include limited data-transmission capabilities, lack of direct customer-control over system configuration and operation, and Centrex's vulnerability to rate increases imposed by state regulators.

Pay Telephones

Product Definition

Pay telephones are sets from which calls can be paid for at the time they are made by means of currency, credit cards, or other, more specialized forms of on-site payment. Typically, each payphone is connected to its own dedicated telco loop, though the instruments may, where tariffs permit, also be hooked up behind key and PBX systems, to party lines, to citywide cellular networks, or to special switches concentrating traffic from several adjacent paysets. The two generic types of pay telephones are "dumb" sets—which depend on the telco's CO-switch both to sense if a call has been completed and authorize collection or refund of a caller's money—and "smart" sets, which rely on internal microprocessors to perform these and other functions, including toll-charge calculations.

Product Applications

Pay telephones provide voice access to the switched phone network from such public places as airports, truck stops, and city sidewalks, and from such semi-public locations as restaurants and other retail stores. Recent technological advances have also made it possible for payphones to provide service from commercial airliners and passenger trains as well. Durable housings enable payphones to withstand the environmental and human-inflicted punishments that come with various locations. Paysets provide the public with access to local and/or long-distance service and let callers reach the telco or long-distance operator, directory assistance, emergency assistance, and toll-free providers. "Dumb" paysets are usually feature-poor, since all their intelligence is supplied by the telco CO-switch. "Smart" paysets, on the other hand, can be programmed to provide computerized calling-instructions, speed dialing, and a range of other sophisticated calling capabilities.

Competitive Products

Pay telephones face potential competition from cellular mobile telephony, which, by enabling callers to take their personal handsets with them wherever they go, could lessen users' need for publicly available phone stations.

Single-Line Telephones

The vast majority of single-line telephones on the market are standard low-featured desk sets, though an increasing number of electronic feature-phones—offering such capabilities as speed dialing and last-number redial—are also being sold. The category of single-line phones also encompasses such sophisticated technologies as cordless phones, cellular sets, and answering machines—as well as such adaptations of the basic phone as one-piece sets, decorator phones, and combination clock/phones. Single-line sets are used primarily in residential and small-business settings.

Distribution Channels

Manufacturers' Distribution Channels

The multiline telephone-equipment market encompasses three distinct levels of suppliers. The first level consists of original equipment manufacturers (OEMs)—such as ROLM, Mitel, and NEC—and exclusive OEM-distributors, such as TIE and Executone. The second level of suppliers consists of wholesale supply houses such as North Supply and Graybar. These companies act as intermediate distribution points between manufacturers and end-user vendors. Wholesalers typically buy equipment in bulk from manufacturers and sell it in smaller lots to vendors, providing warehousing, shipping and, sometimes, financial services to vendors.

The third level is made up of end-user vendors—those companies that sell equipment to, as well as install and maintain it for, end users. End-user vendors consist primarily of third-party interconnect vendors but also include Bell operating company subsidiaries, independent telephone companies, and business-phone retailers. Some manufacturers and exclusive OEM-distributors also sell directly to end users, though wholesale supply houses as a rule do not.

This three-tiered market structure affords manufac-

turers a variety of potential outlets for their products, with the choice of particular distribution channels reflecting manufacturers' overall marketing objectives. Some manufacturers, including several of the largest, maintain branch sales-offices to market their equipment directly to end users, a strategy that offers equipment makers a great degree of control over geographic distribution patterns, pricing, and the level of customer support available with their products. However, manufacturer-direct sales also entail the greatest amount of overhead cost for the manufacturer, while another strategy, wholesaling, generally entails the least amount of overhead—but also provides the manufacturer with the least amount of control over sales and support of his product.

A third strategy is for the manufacturer to sell product to third-party vendors. This type of arrangement generally involves sales at prearranged quotas with volume discounts to vendors, allowing individual vendors to act as authorized dealers of the product within their respective sales areas. Marketing through a third-party vendor generally provides a manufacturer with greater control over the level of marketing and technical support than through wholesalers, but less than through manufacturers' direct-sales offices.

In practice most manufacturers use a combination of two or even all three of these strategies. The particular channels chosen by a given manufacturer generally reflect strategic choices on such issues as the importance of brand-name recognition, the level of technical and marketing support required by the product, and the desirability of maintaining control over the geographic distribution of vendors.

End-User Vendors

It is useful to distinguish several categories of end-user vendors in addition to those mentioned above. NATA breaks end-user vendors into four distinct groupings, distinguished by their historical roles in the market and, to some extent, by the level of regulation to which they are subject.

First, there are the Bell operating companies, the local-exchange-service providers. The BOCs, divested from AT&T in January 1984, still control some 80 percent of U.S. local-exchange traffic. The BOCs—as of this writing (October 1986)—were still required by the FCC to market equipment through unregulated subsidiaries separate from their local-exchange companies. The second category of end-user vendors, independent telephone companies, includes the U.S.'s 1,400 or so non-Bell local-exchange companies. These firms are exempt from the FCC's separate-subsidiary rule and may market equipment in conjunction with their local-exchange services. The third end-user category consists of a single firm, AT&T, former parent of the Bell System. AT&T is not only the U.S.'s largest single equipment manufacturer and supplier, but it is also heir to the entire Bell System embedded base of leased equipment. AT&T is also the largest U.S. long-distance-service provider. As of September 1985, AT&T was exempted from the FCC's separate-subsidiary requirement, freeing the company to market equipment in tandem with its interexchange long-distance services. The fourth category, historically called "interconnects," includes all non-carrier-affiliated vendors. This category includes, in addition to traditional third-party vendors, manufacturers' branch-sales offices as well as business-phone retailers.

EQUIPMENT PRODUCT MARKETS

Key and Hybrid Market

Summary

The market for key and hybrid key telephone systems will enjoy a period of stable, though modest, growth through the rest of the decade. The market will recover from a period of savage competition in 1985 that depressed prices, profits, and sales volumes for many manufacturers and vendors—though some individual industry players saw sales and profits rise over the year. The traditional key system market will remain healthy through the end of the decade as enhanced electronic key systems continue to meet the needs of small-business users and fill the still-substantial market for voice-only telephone service. The market also will benefit from a growing need for low-cost electronic stations for use behind Centrex. However, the market for high-end key systems—supporting 60 to 120 stations per system—will see erosion from low-end digital PBX systems offering data-transmission and other office-automation capabilities.

Shipments

- Manufacturers' annual shipments of key and hybrid key equipment will recover from their 1985 downturn, rising to 4.2 million stations shipped in 1986, and their annual sales volumes and revenues will increase slowly through 1990.
- Shipment growth will be highest in the very small line-sizes as small-business users upgrade to feature-rich electronic equipment.
- Shipments will decline in the higher line-sizes as low-end digital PBX systems capture an increasing share of the present hybrid market.

Installed Base

- The total installed base of key and hybrid key systems will hit 28.9 million stations in 1986 and will grow slowly at a 3.4 percent CAGR between 1985 and 1990.
- As electromechanical and adjunct-key systems are replaced, the installed base will consist increasingly of stand-alone, electronic equipment.

Distribution

- The BOCs are expected to recapture much of their historically dominant share of the key system market.
- Interconnect vendors are adding larger key and hybrid systems to their product lines to boost their sales volumes and profit margins.
- Retail outlets are providing a greater share of distribution at the very low end—2 to 8 stations per system—of the key system market.

Manufacturers' Shipments and Revenues

Manufacturers' annual shipments of, and revenues from, key and hybrid key equipment will grow slowly through 1990. Shipments and revenues suffered a general decline in 1985 from 1984's very strong performance, as forecasted in last year's *NATA Statistical Review*.

- Key and hybrid annual station shipments fell 2.1 percent from 1984's record levels, to 4.15 million stations, in 1985 but will increase to 4.2 million stations shipped in 1986 and continue growing at a 1.5 percent CAGR between 1985 and 1990, to just under 4.5 million stations in 1990.
- Key and hybrid annual system shipments fell 1.8 percent, to 457,600 systems, in 1985 but will grow to 467,600 systems shipped in 1986 and continue climbing at a 2.6 percent CAGR between 1985 and 1990, to 520,160 systems in 1990.
- Manufacturers' annual revenues from key and hybrid shipments fell 8.1 percent, to $955 million, in 1985 but will rebound to $965 million in 1986 and continue rising at a 1.9 percent CAGR between 1985 and 1990, to $1,049 million in 1990.

Table I

KEY & HYBRID MARKET: 1981–1985
ESTIMATED MANUFACTURERS' SHIPMENTS

	1981	1982	1983	1984	1985	1981-1985 CAGR*
AT&T						
Stations (000)	1,540	1,450	950	1,100	1,105	-7.9%
% Share	53.1%	47.5%	28.4%	25.9%	26.6%	
Independent Manufacturers						
Stations (000)	1,360	1,600	2,400	3,140	3,045	22.3%
% Share	46.9%	52.5%	71.6%	74.1%	73.4%	
TOTAL						
Stations (000)	2,900	3,050	3,350	4,240	4,150	
% Growth	3.6%	5.2%	9.8%	26.6%	-2.1%	9.4%
$ Mill.	$ 870	$ 915	$ 921	$1,039	$ 955	
Key & Hybrid Systems (000)	349.4	354.7	372.2	465.9	457.6	
Average Stations/System	8.3	8.6	9.0	9.1	9.1	

KEY & HYBRID MARKET: 1986–1990
PROJECTED MANUFACTURERS' SHIPMENTS

	1986	1987	1988	1989	1990	1986-1990 CAGR*
AT&T						
Stations (000)	1,120	1,135	1,155	1,175	1,200	1.7%
% Share	26.7%	26.7%	26.8%	26.9%	26.9%	
Independent Manufacturers						
Stations (000)	3,074	3,111	3,155	3,200	3,263	1.5%
% Share	73.3%	73.3%	73.2%	73.1%	73.1%	
TOTAL						
Stations (000)	4,194	4,246	4,310	4,375	4,463	
% Growth	1.1%	1.3%	1.5%	1.5%	2.0%	1.6%
$ Mill.	$ 965	$ 977	$ 991	$1,028	$1,049	
Key & Hybrid Systems (000)	467.6	478.7	491.5	504.0	520.2	
Average Stations/System	9.0	8.9	8.8	8.7	8.6	

Source: NATA

*Compound Annual Growth Rate. CAGRs in the narrative of this study can be assumed to refer to rates calculated between the years 1985 and 1990, unless otherwise noted. The rates in this table are given separately for the years 1981 through 1985 and the years 1986 through 1990.

These tables show estimated total shipments of key and hybrid telephone equipment at the original equipment manufacturers' (OEM) level intended for U.S. markets, including imports. "Independent Manufacturers" refers to all non-AT&T suppliers. Estimated shipments include systems destined for installation behind PBX systems and Centrex service, as well as those configured as stand-alone systems.

Manufacturers' Distribution Channels

Manufacturers' equipment-distribution channels comprise all suppliers and vendors to whom equipment makers ship their products directly, consisting of manufacturers' own branch sales-offices as well as wholesalers, interconnects, BOCs, and independent telcos. Only wholesale suppliers generally resell this merchandise to other vendors—including interconnects, BOCs, and independent telcos—who make final sales to end users.

In this study, manufacturers' distribution shares refer to manufacturers' proportionate shipments to the various supplier/vendor categories. End-user vendor shares, on the other hand, refer to each vendor category's share of the industry's total sales to the ultimate consumers. For purposes of this study, all manufacturers' branch sales-offices are treated as a single category in the discussion on manufacturer distribution channels but—excepting AT&T—are treated as interconnects in the discussion on end-user vendor shares.

Shipments of key and hybrid equipment by manufacturer distribution channel in 1985 are shown in Table II.

- Among manufacturer distribution channels, manufacturer-direct sales and the BOCs are expected to grow the fastest over the coming five years, at the expense of interconnects and supply houses.

- Manufacturers' shipments to interconnect vendors in 1985 accounted for 42.7 percent of total shipments, while manufacturer-direct sales accounted for 29.3 percent.

- Manufacturers' shipments to BOCs and wholesale supply houses were about equal in 1985—at 10.9 and 11.5 percent, respectively—while independent telcos accounted for the smallest share, at 5.6 percent.

Table II

KEY & HYBRID SHIPMENTS BY MANUFACTURERS' DISTRIBUTION CHANNEL: 1985

	Stations (000)	% Share
Manufacturer Direct	1,215	29.3%
Interconnect Vendors	1,774	42.7%
Wholesale Supply Houses	475	11.5%
Bell Operating Companies	455	10.9%
Independent Operating Companies	231	5.6%
TOTAL	4,150	100%

Source: NATA

End-User Sales

- Vendors' sales of key and hybrid equipment to end users stood at an estimated $2,054 million in 1985, down almost 12 percent from 1984.

- Vendors' annual revenues from sales to end users will increase at a 2.3 percent CAGR through 1990, to $2,300 million.

- The average price per station for key and hybrid equipment fell slightly, to about $500 per station, in 1985 and will grow to only $515 per station by 1990.

End-User Vendor Shares

Interconnects' and independent telcos' shares of sales to end users are projected to drop, while the BOCs' share is projected to rise over the remainder of the decade. End-user vendor-share estimates have been revised from last year's figures, based on new shipment projections as well as more comprehensive reporting from manufacturers on the distribution of their products. The new figures show the BOCs with a lower, and the interconnects with a higher, end-user vendor share than was previously estimated.

- Interconnects' share is projected to drop from 53 percent in 1985 to 35 percent in 1990, and independent telcos' share will decline from 9.3 percent to 8.5 percent over that period.

- AT&T's share will remain essentially unchanged, at between 26 and 27 percent, through 1990, while the BOCs' share is expected to jump from 11 percent in 1985 to 29.5 percent in 1990.

Installed Base

Total Installed Base

- The total installed base of key and hybrid stations (including both stand-alone and adjunct key equipment) increased 2.0 percent in 1985, to 28.2 million stations, and will grow to 28.9 million stations in 1986 and continue rising at a 3.4 percent CAGR between 1985 and 1990, to 33.3 million stations in 1990.

- The total number of key and hybrid systems grew by 1.3 percent in 1985, to 5.151 million, and will increase to 5.255 million in 1986 and continue growing by a 3.4 percent CAGR between 1985 and 1990, to 6,084 thousand systems in 1990.

- The total installed base averaged 5.5 stations per system in 1985.

Stand-Alone Installed Base

- The stand-alone portion of the total installed base increased 3.9 percent in 1985, to 18.8 million stations, and will grow to 19.6 million stations in 1986 and continue climbing at a 4.9 percent CAGR between 1985 and 1990, to 23.9 million stations in 1990.

- The number of stand-alone systems grew by 3.5 percent in 1985, to 3.018 million systems, and will reach 3.142 million in 1986 and continue climbing at a 5.5 percent CAGR between 1985 and 1990, to 3.945 million systems in 1990.

- The stand-alone installed base averaged 6.2 stations per system in 1985.

Adjunct-Key Installed Base

- The adjunct-key portion of the total installed base declined 1.7 percent in 1985, to 9.4 million stations, and will decline to less than 9.3 million stations in 1987, after which it will grow marginally through 1990.

- The number of adjunct key systems decreased by 1.7 percent in 1985, to 2.133 million systems, and will decline to 2.108 million in 1987, after which it will grow marginally through 1990.

- The adjunct-key installed base averaged 4.4 stations per system in 1985.

Replacement Rates

Users' replacement of older systems in the installed base by new equipment—a process known as "churn"—continues to account for the largest portion of annual key and hybrid sales. The 1984 product glut and ensuing price war stimulated already-high replacement rates for older in-place key and hybrid equipment.

Table III

KEY & HYBRID SALES TO END USERS BY VENDOR CATEGORY: 1985 & 1990

	1985			1990		
	Stations (000)	Dollars ($ Mill.)	% Share	Stations (000)	Dollars ($ Mill.)	% Share
Interconnect Vendors	2,202	$1,090	53.1%	1,567	$ 807	35.1%
AT&T	1,105	$ 547	26.6%	1,200	$ 618	26.9%
Bell Operating Companies	457	$ 226	11.0%	1,317	$ 678	29.5%
Independent Operating Companies	386	$ 191	9.3%	379	$ 195	8.5%
TOTAL	4,150	$2,054	100%	4,463	$2,298	100%

Source: NATA

Table IV

KEY & HYBRID TELEPHONE MARKET: 1981–1985
INSTALLED BASE DEVELOPMENT

	1981	1982	1983	1984	1985	1981-1985 CAGR*
STAND-ALONE KEY & HYBRID						
Bell Operating Companies						
Stations (000)	12,636	12,773	11,350	241	556	
% Growth	1.7%	1.1%	−11.1%	†	130.7%	†
% Share	78.9%	76.2%	65.6%	1.3%	2.9%	
Independent Operating Companies						
Stations (000)	1,741	1,786	1,833	2,055	2,091	
% Growth	2.8%	2.6%	2.6%	12.1% †	1.8%	4.7% †
% Share	10.9%	10.7%	10.6%	11.4%	11.1%	
AT&T						
Stations (000)	N/A	N/A	650	11,120	10,504	
% Growth				†	−5.5%	†
% Share			3.8%	61.5%	55.9%	
Interconnect Vendors						
Stations (000)	1,635	2,190	3,465	4,666	5,649	
% Growth	32.1%	33.9%	58.2%	34.7%	21.1%	36.3%
% Share	10.2%	13.1%	20.0%	25.8%	30.1%	
TOTAL STAND-ALONE KEY & HYBRID						
Stations (000)	16,012	16,749	17,298	18,082	18,800	
% Growth	4.2%	4.6%	3.3%	4.5%	3.9%	4.1%
Systems (000)	2,668.7	2,745.7	2,799.0	2,916.5	3,017.7	3.1%
Average Stations/System	6.0	6.1	6.2	6.2	6.2	
ADJUNCT KEY						
Stations (000)	9,814	9,772	9,730	9,543	9,386	
% Growth	0.4%	−0.4%	−0.4%	−1.9%	−1.7%	−1.1%
Systems (000)	2,230.5	2,220.9	2,211.4	2,168.9	2,133.2	−1.1%
Average Stations/System	4.4	4.4	4.4	4.4	4.4	
TOTAL KEY & HYBRID						
Stations (000)	25,826	26,521	27,028	27,625	28,186	
% Growth	2.7%	2.7%	1.9%	2.2%	2.0%	2.2%
Systems (000)	4,899.2	4,966.6	5,010.4	5,085.4	5,150.9	1.3%
Average Stations/System	5.3	5.3	5.4	5.4	5.5	

Source: NATA

*Compound Annual Growth Rate. CAGRs in the narrative of this study can be assumed to refer to rates calculated between the years 1985 and 1990, unless otherwise noted. The rates in this table are given separately for the years 1981 through 1990.

†Growth rates for the Bell operating companies (BOCs) and AT&T are not shown for 1984 because of the transfer of the embedded base from the BOCs to AT&T. Growth for the independent operating companies is artificially inflated in 1984 due to the shift of Southern New England Telephone (SNET) and Cincinnati Bell (CBI) into that category. Similarly, compound annual growth rates are not shown for the BOCs or AT&T because of distortions caused by the transfer of the installed base.

Table IV

KEY & HYBRID TELEPHONE MARKET: 1986–1990
INSTALLED BASE PROJECTIONS

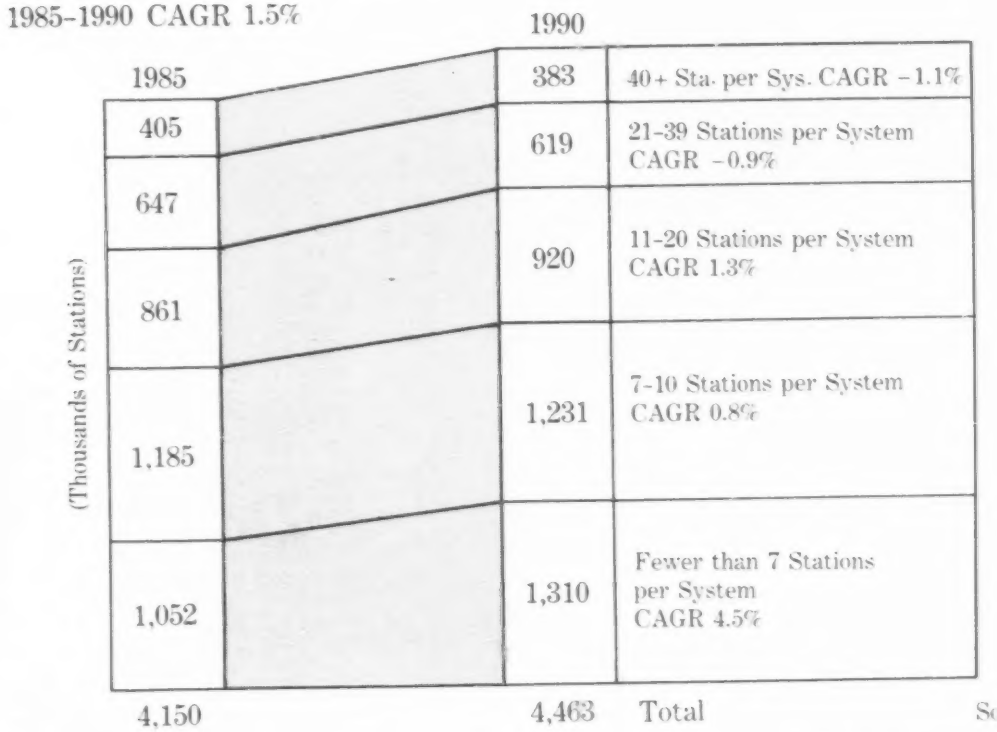
	1986	1987	1988	1989	1990	1981-1985 CAGR*
STAND-ALONE KEY & HYBRID						
Bell Operating Companies						
Stations (000)	976	1,511	2,165	2,897	3,706	
% Growth	75.5%	54.8%	43.3%	33.8%	27.9%	39.6%
% Share	4.9%	7.4%	10.0%	12.7%	15.5%	
Independent Operating Companies						
Stations (000)	2,126	2,161	2,197	2,231	2,261	
% Growth	1.7%	1.7%	1.7%	1.6%	1.3%	1.6%
% Share	10.9%	10.6%	10.2%	9.8%	9.5%	
AT&T						
Stations (000)	10,014	9,716	9,635	9,682	9,712	
% Growth	−4.7%	−2.9%	−0.8%	0.5%	0.3%	−0.8%
% Share	51.2%	47.4%	44.6%	42.5%	40.7%	
Interconnect Vendors						
Stations (000)	6,456	7,105	7,603	7,950	8,187	
% Growth	14.3%	10.1%	7.0%	4.6%	2.9%	6.1%
% Share	33.0%	34.7%	35.2%	34.9%	34.3%	
TOTAL STAND-ALONE KEY & HYBRID						
Stations (000)	19,572	20,493	21,600	22,760	23,866	
% Growth	4.1%	4.7%	5.4%	5.4%	4.9%	5.1%
Systems (000)	3,141.6	3,305.3	3,512.2	3,731.2	3,944.8	5.9%
Average Stations/System	6.2	6.2	6.2	6.1	6.1	
ADJUNCT KEY						
Stations (000)	9,299	9,276	9,288	9,322	9,412	
% Growth	−0.9%	−0.3%	0.1%	0.4%	1.0%	0.3%
Systems (000)	2,113.4	2,108.2	2,110.9	2,118.6	2,139.1	0.3%
Average Stations/System	4.4	4.4	4.4	4.4	4.4	
TOTAL KEY & HYBRID						
Stations (000)	28,871	29,769	30,888	32,082	33,278	
% Growth	2.4%	3.1%	3.8%	3.9%	3.7%	3.6%
Systems (000)	5,255.0	5,413.5	5,623.1	5,849.8	6,083.9	3.7%
Average Stations/System	5.5	5.5	5.5	5.5	5.5	

Source: NATA

"Installed base" refers to the cumulative total of equipment in use at the end of each calendar year. "Stand-alone" refers to key and hybrid systems connected directly to telephone company central-office lines. "Adjunct" refers to key equipment connected behind a PBX system or Centrex service.

The 22 wholly owned BOCs were divested by AT&T on January 1, 1984, and were regrouped into seven independent regional companies. At the time of divestiture the BOCs' entire installed base of key and hybrid equipment was transferred to AT&T. Two companies historically counted as part of the Bell System, SNET and CBI, were not included in the AT&T divestiture and their installed base was transferred to the "independent operating company" category in the 1984 column.

ESTIMATED KEY & HYBID SHIPMENTS BY LINE SIZE: 1985 & 1990



Source: NATA

- Users' annual replacement rate for all key and hybrid equipment fell to 13 percent in 1985 and will decline steadily, to 10.2 percent in 1990. Replacement reached a peak in 1984, when nearly 13.5 percent of the installed base was supplanted by newer systems.

- Electromechanical, 1A2-type systems fell to less than one-half the total installed base in 1985 but continue to represent the largest potential pool of replaceable equipment.

- As the installed base of 1A2 declines through the rest of the decade, annual replacements for the total annual installed base will also decline.

- Annual replacements of the adjunct-key-system portion of the installed base will decline from a high of 15 percent in 1984 to 11.1 percent in 1990.

- Annual replacements of the stand-alone portion of the key and hybrid system installed base will decline from an estimated 12.6 percent in 1984 to 9.8 percent in 1990.

Churn can be measured also by the percentage of manufacturers' annual equipment shipments that replaces older in-place equipment—as opposed to equipment shipped and sold for new installations.

- In the mid- to late-1970s, 75 to 80 percent of annual key and hybrid shipments were sold as replacements for older systems.

- The portion of annual key and hybrid shipments sold as replacements peaked in 1985, with an estimated 86 percent of new key and hybrid equipment shipped that year for replacement purposes. Annual shipments intended as replacements will decline to 73 percent by 1990.

Table V

ESTIMATED KEY & HYBRID SHIPMENTS BY LINE SIZE: 1985 & 1990

	1985	1990	1985–1990 CAGR*
1–6 Stations per System			
Stations (000)	1,052	1,310	4.5%
Systems (000)	211.6	275.8	5.4%
Average Stations per System	4.9	4.8	
7–10 Stations per System			
Stations (000)	1,185	1,231	0.8%
Systems (000)	153.8	155.8	0.3%
Average Stations per System	7.7	7.9	
11–20 Stations per System			
Stations (000)	861	920	1.3%
Systems (000)	57.6	57.5	−0.1%
Average Stations per System	14.9	16.0	
21–39 Stations per System			
Stations (000)	647	619	−0.9%
Systems (000)	25.9	23.7	−1.8%
Average Stations per System	24.9	26.1	
40+ Stations per System			
Stations (000)	405	383	−1.1%
Systems (000)	8.5	7.4	−2.5%
Average Stations per System	47.7	51.8	
TOTAL			
Stations (000)	4,150	4,463	1.5%
Systems (000)	457.4	520.2	2.6%
Average Stations per System	9.1	8.6	

Source: NATA

*Compound Annual Growth Rate. CAGRs in the narrative of this study can be assumed to refer to rates calculated between the years 1985 and 1990, unless otherwise noted. The rates in this table are given for the years 1985 through 1990.

Market Segments

Line Sizes

Table V details estimates and projections of key/hybrid station and system shipments by standard line-size categories.

- Highest growth for key and hybrid system shipments will be in the very smallest line-size category (under 7 stations per system) with declines expected for the larger line-size segments (over 20 stations per system).

- The current surge in sales of very small key systems will continue, as small businesses demand more sophisticated voice-processing capabilities from their telephone systems.

- Continuing growth in small key-system sales results

in part from an increasing need for low-cost station equipment to serve as adjuncts to Centrex service.

- Sales of larger key and hybrid systems will suffer from inroads by small PBX systems.

- The average number of key/hybrid stations per system has been growing steadily since the early 1980s as a result of increased sales of the larger-line-size hybrid systems. The average key/hybrid system shipped in 1981 had roughly 8.3 stations, while in 1985 the average had risen to 9.1 stations per system.

- The stations-to-system ratio for key and hybrid equipment shipments peaked in 1984 at 9.1 and is expected to decline steadily through 1990.

- In the installed base, the average number of stations per system has increased from about 5.3 in 1981 to 5.5 in 1985, and is expected to remain stable through 1990.

Electromechanical/1A2 vs. Electronic/Hybrid Key Systems

- Shipments of electromechanical 1A2-type key stations declined from over 25 percent of total key stations shipped in 1983 to just over 6 percent in 1985.

- Electromechanical key equipment declined from 56.5 percent of the key/hybrid installed base in 1984 to 44 percent in 1985, and will account for only 14 percent of the base in 1990.

- The 1A2 market will probably survive for another three to five years, primarily as a "parts market" for installed systems.

- Electronic and hybrid key systems shipments increased at nearly a 25 percent CAGR between 1983 and 1985 and are expected to replace 1A2 equipment shipments completely by 1990.

Adjunct-Key Systems

Manufacturers' shipments of key equipment for use as adjuncts to PBX systems and/or Centrex service have been declining steadily over the past several years as proprietary multibutton feature-phones take over the traditional role of key equipment behind PBXs.

- Adjunct-key equipment declined from over 33 percent of total key and hybrid station shipments in 1983 to 28 percent in 1985, and will fall to 25 percent by 1990.

- While adjunct-key equipment shipments will continue to decline as a percentage of total key and hybrid shipments, the actual number of stations shipped will stabilize in 1988, at about 1.1 million stations, and remain relatively stable through 1990. This partial recovery will stem from rising demand for low-featured, electronic products for use behind Centrex services.

PBX and Centrex Market

Summary

The PBX market grew at a healthy clip in 1985, though not as strongly as the revised estimates of 1984's growth. Steady, moderate growth for the PBX market is projected through the end of the decade, with continued competition at the low end (under 100 lines per system) from both Centrex services and hybrid key systems and renewed competition at the high end (over 500 stations per system) from Centrex beginning about 1988. The shakeout of marginal PBX manufacturers and vendors accelerated in 1985 and is expected to continue at least through 1987. For players in the PBX market, both prices and aggregate profit margins declined in 1985, but prices should begin rising to more comfortable levels after 1986.

Shipments

- PBX manufacturers' annual shipments will reach 4.3 million stations shipped in 1986 and will grow by a 5.5 percent CAGR through the end of the decade, from 4.1 million stations in 1985 to 5.4 million stations in 1990.

- Manufacturers' annual shipments of analog PBX systems will continue to decline steadily, accounting for only about 3 percent of total PBX shipments annually by 1990.

- Manufacturers' annual shipments of data lines (extensions dedicated to data transmission on integrated voice-and-data PBX systems) will grow from about 4.5 percent of stations shipped in 1985 to around 9 percent in 1990.

Installed Base

- The total installed base of PBX stations will rise to 24.6 million stations in 1986 and grow at a 6.5 percent CAGR through the end of the decade, from 23.2 million stations in 1985 to 31.8 million stations in 1990.

- Replacement of older in-place equipment accounted for over 65 percent of PBX sales in 1985. Displacement of older, analog-type systems by digital PBX switches will continue to constitute the bulk of PBX system sales through 1990.

- The proportion of digital PBX equipment in the total PBX installed base will grow from an estimated 40 percent of PBX stations in 1985 to over 80 percent in 1990.

End-User Sales

- Vendors' revenues from PBX sales to end users will increase from $2,983 million in 1985 to $3,147 million in 1986 and continue rising to $4,146 million in 1990.

- PBX market growth will be highest in the very large line-size segment, where system-replacement rates are high, and lowest in the 100- to 400-stations-per-system segment due to market saturation in this heavily targeted sector.

Distribution

- The BOCs and AT&T will continue gaining PBX market share through 1990, while interconnect vendors' and independent telephone operating companies' shares will decline.

Centrex

- New Centrex-station installations will grow at a 10.5 percent CAGR through 1990, while the installed base of Centrex stations will increase at about a 3.3 percent CAGR, from 7.9 million in 1985 to 9.3 million in 1990.

- Telcos' annual revenues from Centrex services will grow from an estimated $1,604 million in 1985 to $1,887 million in 1990.

Manufacturers' Shipments/Revenues and Centrex Installations

The estimate in last year's *NATA Statistical Review* of manufacturers' PBX shipments in 1984 has been revised upward by about 8.5 percent—from 3.49 million stations estimated last year to 3.79 million stations. This revision follows NATA's initiation of a comprehensive quarterly written survey of customer premises equipment (CPE) manufacturers, the results of which showed that the estimate of industry PBX shipments in 1984 was too low. New estimates show a 15.9 percent increase in 1984 over 1983 PBX shipments, with manufacturers' revenues from PBX shipments in 1984 amounting to $1,175 million, as compared to $1,082 million estimated last year.

- PBX manufacturers' annual station shipments grew 8.6 percent in 1985, to 4.1 million stations, and are projected at 4.3 million stations in 1986. Shipments will increase at about a 5.5 percent CAGR between 1985 and 1990, to 5.4 million stations shipped in 1990.

- PBX manufacturers' annual system shipments grew 2.6 percent, to 26,830 systems, in 1985 and are projected at 28,000 systems shipped in 1986. Shipments will increase at a 5.6 percent CAGR between 1985 and 1986, to 35,200 systems in 1990.

- PBX manufacturers' annual revenues were $1,214 million in 1985—an increase of 3.3 percent over 1984. They are expected to reach $1,280 million in 1986 and will continue growing at a 6.9 percent CAGR between 1985 and 1990, reaching $1,696 million in 1990.

Centrex services—provided by local telephone companies—employ dedicated access lines and a portion of the local-exchange switch, all governed by generic software functions. These Centrex service components are available to users under a bundled pricing package regulated by state authorities. The telco facilities pro-

Table VI

PBX MARKET: 1981–1985
ESTIMATED MANUFACTURERS' SHIPMENTS

	1981	1982	1983	1984	1985	1981-1985 CAGR*
AT&T						
Stations (000)	1,160	1,000	800	955	1,150	-0.22%
% Share	40.5%	32.5%	24.5%	25.2%	27.9%	
Independent Manufacturers						
Stations (000)	1,705	2,080	2,470	2,835	2,965	14.8%
% Share	59.5%	67.5%	75.5%	74.8%	72.1%	
TOTAL						
Stations (000)	2,865	3,080	3,270	3,790	4,115	
% Growth	7.7%	7.5%	6.2%	15.9%	8.6%	9.5%
$ Mill.	$ 955	$1,026	$1,092	$1,175	$1,214	
PBX Systems (000)	24.9	25.0	25.2	26.1	26.8	
Average Stations/System	115	123	130	145	153	

PBX MARKET: 1986–1990
PROJECTED MANUFACTURERS' SHIPMENTS

	1986	1987	1988	1989	1990	1986-1990 CAGR*
AT&T						
Stations (000)	1,250	1,350	1,425	1,500	1,575	5.9%
% Share	28.8%	29.4%	29.4%	29.4%	29.3%	
Independent Manufacturers						
Stations (000)	3,090	3,235	3,415	3,605	3,810	5.4%
% Share	71.2%	70.6%	70.6%	70.6%	70.7%	
TOTAL						
Stations (000)	4,340	4,585	4,840	5,105	5,385	
% Growth	5.5%	5.7%	5.6%	5.5%	5.5%	5.5%
$ Mill.	$1,280	$1,376	$1,476	$1,583	$1,696	
PBX Systems (000)	28.0	29.3	31.2	33.0	35.2	
Average Stations/System	155	156	155	154	153	

Source: NATA

*Compound Annual Growth Rate. CAGRs in the narrative of this study can be assumed to refer to rates calculated between the years 1985 and 1990, unless otherwise noted. The rates in this table are given separately for the years 1981 through 1985 and 1986 through 1990.

These tables show estimates of total PBX equipment shipments at the original equipment manufacturers' (OEM) level intended for the U.S. market, including imports. "Independent Manufacturers" includes all non-AT&T suppliers.

viding Centrex can easily support other types of network services, resulting in no direct correlation between new shipments of CO equipment and new lines of Centrex.

- New annual Centrex-service installations amounted to an estimated 720,000 CO access-lines in 1985, or approximately 825,000 stations.

- New annual Centrex-service installations will increase at about an 11.1 percent CAGR through the end of the decade, to 1.2 million new access lines and 1.4 million new stations between 1985 and 1990.

Manufacturers' Distribution Channels

Shipments of PBX equipment by manufacturer distribution channels in 1985 are shown in Table VII.

- Manufacturers' annual shipments to their own direct-sales forces and to interconnect vendors were the largest categories in 1985, with 48.5 and 25 percent of total shipments, respectively.

- Manufacturers' annual shipments to supply houses in 1985 accounted for 10.6 percent of the total; the BOCs, 10.4 percent; and the independent telephone operating companies, 5.5 percent.

- Manufacturers' shipments to their own direct-sales forces and to the BOCs will grow the fastest over the coming five years, at the expense of shipments to interconnect companies and supply houses.

Table VII

PBX SHIPMENTS BY MANUFACTURERS' DISTRIBUTION CHANNEL: 1985

	Stations (000)	% Share
Manufacturer Direct	1,996	48.5%
Interconnect Vendors	1,029	25.0%
Wholesale Supply Houses	436	10.6%
Bell Operating Companies	427	10.4%
Independent Operating Companies	227	5.5%
TOTAL	4,115	100%

Source: NATA

End-User Sales

- Vendors' annual sales of PBX equipment to end users totaled $2,983 million in 1985, up 1.6 percent from the 1984 level, and are projected at $3,147 million in 1986.

- Vendors' annual revenues from sales of PBX equipment to end users will increase at a healthy 6.8 percent CAGR between 1985 and 1990, to $4,146 million in 1990.

- The average price-per-station for PBX equipment fell in 1985—to an average $725 per station—but will remain stable through 1987, after which year the price-per-station will rise to $770 by 1990.

- Annual revenues generated by Centrex services totaled approximately $1,604 million in 1985 and will increase to about $1,887 million by 1990.

- Average monthly Centrex revenues are calculated by multiplying an estimate of average monthly dollar-per-Centrex-station by the number of commercial Centrex stations in service.

- The average monthly revenues per Centrex station are approximately $18.50, the equivalent of $222 annually. About 91 percent of total Centrex stations in use are for commercial accounts, with the remaining 9 percent for telcos' intracompany use. (Revenues are projected on a constant-dollar basis and assume no average price increases for Centrex service.)

End-User Vendor Shares

Vendors' sales of PBX equipment to end users have been revised substantially from last year's estimates, based both on revised shipment projections and on more comprehensive reporting from manufacturers as to how their products are distributed. The market share at-

Table VIII

PBX SALES TO END USERS BY VENDOR CATEGORY: 1985 & 1990

	1985			1990		
	Stations (000)	Dollars ($ Mill.)	% Share	Stations (000)	Dollars ($ Mill.)	% Share
Interconnect Vendors	2,130	$1,544	51.8%	2,044	$1,573	37.9%
AT&T	1,150	$ 834	27.9%	1,575	$1,213	29.3%
Bell Operating Companies	432	$ 313	10.5%	1,346	$1,037	25.0%
Independent Operating Companies	403	$ 292	9.8%	420	$ 323	7.8%
TOTAL	4,115	$2,983	100%	5,385	$4,146	100%

Source: NATA

tributed to the BOCs for 1985 has been lowered from the 15.7 percent estimated in last year's study to 10.5 percent, and the interconnect share raised from 47.1 percent to 51.8 percent. Nevertheless, the overall trend identified in last year's *NATA Statistical Review*—of declining market share for interconnect and independent telephone operating companies and increasing share for the BOCs—still holds true. Table VIII shows actual 1985 market shares by vendor category and projects vendor shares for 1990.

- Interconnect vendors' share of sales to end users will decline from 51.8 percent of total industry sales in 1985 to 38 percent in 1990.

- Independent telcos' share will fall from 9.8 percent in 1985 to 7.8 percent in 1990.

- AT&T's share will rise marginally, from 28 percent in 1985 to 29.3 percent in 1990.

- The BOCs' share will surge from 10.5 percent to 25 percent between 1985 and 1990.

Installed Base

Total Installed Base

- The total installed base of both PBX and Centrex stations increased by 4.5 percent in 1985, to 31.1 million stations, and is expected to reach 32.7 million stations in 1986. The total installed base will grow at a 5.7 percent CAGR between 1985 and 1990, to 41.1 million stations in 1990.

- The Centrex portion of the PBX/Centrex installed base grew 1.2 percent in 1985, to 7.9 million stations, and is projected at 8.1 million stations in 1986. The Centrex base will continue growing at a 3.3 percent CAGR between 1985 and 1990, to 9.3 million stations in 1990.

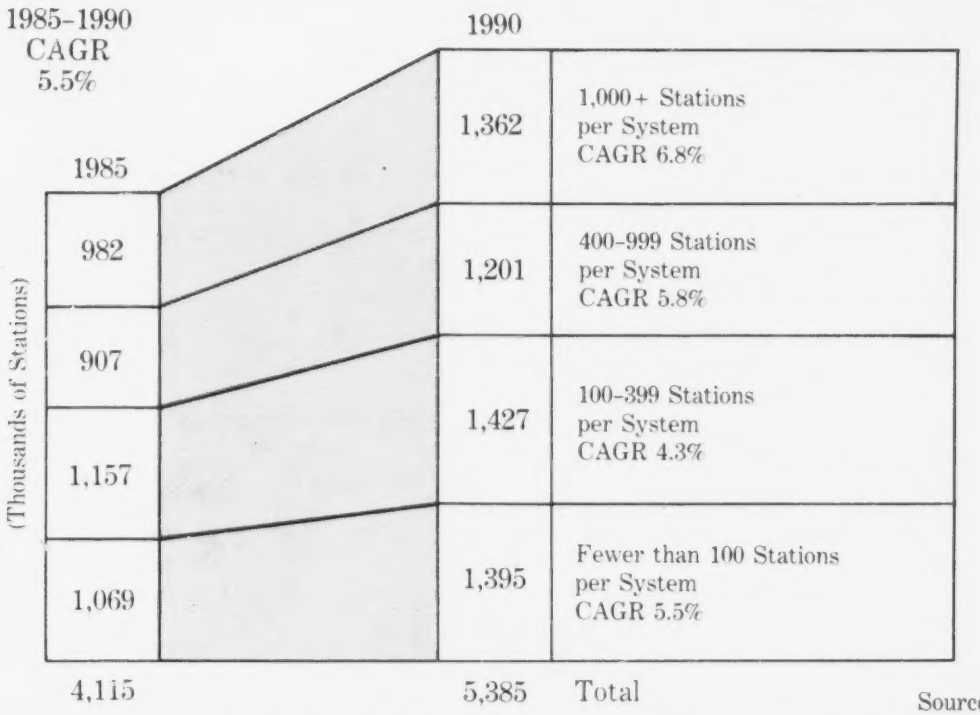
PBX Installed Base

- The PBX installed base grew by 5.7 percent in 1985, to 23.2 million stations, and is expected to reach 24.6 million stations in 1986. The PBX base will increase at a 6.5 percent CAGR between 1985 and 1990, to 31.8 million stations in 1990.

- The installed base of PBX systems increased 5.2 percent in 1985, to 211,700 systems, and will grow to 223,500 systems in 1986. The installed base of systems will increase at a 6.3 percent CAGR between 1985 and 1990, to 287,600 systems in 1990.

- In-place PBX systems had an average of 109 stations in 1985 and will have an average of 111 stations by 1990.

ESTIMATED PBX SHIPMENTS BY LINE SIZE: 1985 & 1990



Source: NATA

Replacement Rates

- Users' replacement of older PBX systems in the installed base by new equipment accounted for 67.5 percent of all new PBX station shipments in 1985, up slightly from 67 percent in 1984.
- PBX shipments intended as replacements will decline as a percentage of total PBX shipments through 1990.
- Users replaced an estimated 13.1 percent of in-place PBX stations in 1985, up from 12.4 percent in 1984.
- User replacement of existing PBX stations in the installed base will average about 12 percent annually through 1990.

Market Segments

Line-Size Groupings

Table X illustrates estimates and projections of PBX station and system shipments by standard line-size categories.

- The very large PBX market, despite increasing competition from Centrex beginning about 1988, will benefit from rapid replacement of older-technology PBXs and aging Centrex installations by new integrated voice-data PBX systems.
- PBX shipment growth will be highest in the very large line-sizes and weakest in the 100- to 400-stations-per-system range. The 100- to 400-stations-per-

Table IX

PBX-CENTREX MARKET: 1981–1985
INSTALLED BASE DEVELOPMENT

	1981	1982	1983	1984	1985	1981-1985 CAGR*
PBX						
Bell Operating Companies						
Stations (000)	10,450	10,795	9,825	322	754	
% Growth	3.4%	3.3%	-8.9%	†	134.2%	†
% Share	58.6%	55.7%	47.4%	1.5%	3.3%	
Independent Operating Companies						
Stations (000)	2,431	2,410	2,450	2,730	2,806	
% Growth	2.7%	-0.9%	1.7%	11.4%†	2.8%	3.7% †
% Share	13.6%	12.4%	11.8%	12.5%	12.1%	
AT&T						
Stations (000)	N/A	N/A	800	9,910	9,524	
% Growth			†	†	-3.9%	†
% Share			3.9%	45.2%	41.1%	
Interconnect Vendors						
Stations (000)	4,969	6,173	7,640	8,972	10,092	
% Growth	18.0%	24.2%	21.0%	17.4%	12.5%	19.4%
% Share	27.8%	31.9%	36.9%	40.9%	43.6%	
TOTAL PBX						
Stations (000)	17,850	19,378	20,715	21,934	23,176	
% Growth	6.9%	8.6%	4.5%	5.9%	5.7%	6.8%
PBX Systems (000)	170.0	181.1	191.8	201.2	211.7	5.6%
Average Stations/System	105	107	108	109	109	
CENTREX						
Stations (000)	8,495	8,001	7,814	7,846	7,942	
% Growth	-1.7%	-5.8%	1.7%	0.4%	1.2%	-1.7%
TOTAL PBX & CENTREX						
Stations (000)	26,345	27,379	28,529	29,780	31,118	
% Growth	4.0%	3.9%	4.2%	4.4%	4.5%	4.3%

Source: NATA

*Compound Annual Growth Rate. CAGRs in the narrative of this study can be assumed to refer to rates calculated between the years 1985 and 1990, unless otherwise noted. The rates in this table are given separately for the years 1981 through 1985 and 1986 and 1990.

†Growth rates for the Bell operating companies (BOCs) and AT&T are not shown for 1984 because of the transfer of the embedded base from the BOCs to AT&T. Growth for the independent operating companies is artificially inflated in 1984 due to the shift of Southern New England Telephone (SNET) and Cincinnati Bell (CBI) into that category. Similarly, compound annual growth rates are not shown for the BOCs or AT&T because of distortions caused by the transfer of the installed base.

Table IX

PBX-CENTREX MARKET: 1986–1990
INSTALLED BASE PROJECTIONS

	1986	1987	1988	1989	1990	1986–1990 CAGR*
PBX						
Bell Operating Companies						
Stations (000)	1,305	1,993	2,879	3,917	5,067	
% Growth	73.1%	52.7%	44.5%	36.1%	29.4%	40.4%
% Share	5.3%	7.6%	10.3%	13.1%	15.9%	
Independent Operating Companies						
Stations (000)	2,875	2,940	2,989	3,034	3,075	
% Growth	2.5%	2.3%	1.7%	1.5%	1.4%	1.7%
% Share	11.7%	11.2%	10.7%	10.2%	9.7%	
AT&T						
Stations (000)	9,393	9,475	9,668	9,935	10,268	
% Growth	−1.4%	0.9%	2.0%	2.8%	3.4%	2.3%
% Share	38.2%	36.1%	34.5%	33.3%	32.3%	
Interconnect Vendors						
Stations (000)	11,008	11,817	12,483	12,971	13,393	
% Growth	9.1%	7.4%	5.6%	3.9%	3.3%	5.0%
% Share	44.8%	45.1%	44.6%	43.4%	42.1%	
TOTAL PBX						
Stations (000)	24,581	26,225	28,019	29,857	31,803	
% Growth	6.1%	6.7%	6.8%	6.6%	6.5%	6.7%
PBX Systems (000)	223.5	237.3	252.4	268.9	287.6	6.5%
Average Stations/System	110.0	110.5	111.0	111.0	110.6	
CENTREX						
Stations (000)	8,115	8,374	8,672	8,991	9,324	
% Growth	2.2%	3.2%	3.6%	3.7%	3.7%	3.5%
TOTAL PBX & CENTREX						
Stations (000)	32,696	34,599	36,691	38,848	41,127	
% Growth	5.1%	5.8%	6.1%	5.9%	5.9%	5.9%

Source: NATA

"Installed base" refers to the cumulative total of equipment in use at the end of each calendar year. PBX stations are the equivalent of equipped lines. Centrex figures include all station equipment, both main stations and extensions, connected behind Centrex service.

The 22 wholly owned BOCs were divested by AT&T on January 1, 1984, and were regrouped into seven independent regional companies. At the time of divestiture the BOCs' installed base of approximately 9.8 million PBX stations was transferred to AT&T. Two companies historically counted as part of the Bell System, SNET and CBI, were not included in the AT&T divestiture and their PBX installed base was transferred to the "independent operating company" category in the 1984 column.

Table X

ESTIMATED PBX SHIPMENTS BY LINE SIZE: 1985 & 1990

	1985	1990	1985–1990 CAGR*
Under 100 Stations per System			
Stations (000)	1,069	1,395	5.5%
Systems (000)	17.5	23.8	6.4%
Average Stations per System	61	59	
100–399 Stations per System			
Stations (000)	1,157	1,427	4.3%
Systems (000)	7.6	9.0	3.6%
Average Stations per System	152	158	
400–999 Stations per System			
Stations (000)	907	1,201	5.8%
Systems (000)	1.4	1.9	5.4%
Average Stations per System	635	645	
1,000+ Stations per System			
Stations (000)	982	1,362	6.8%
Systems (000)	0.3	0.5	6.7%
Average Stations per System	2,958	2,960	
TOTAL			
Stations (000)	4,115	5,385	5.5%
Systems (000)	26.8	35.2	5.6%
Average Stations per System	153	153	

Source: NATA

*Compound Annual Growth Rate. CAGRs in the narrative of this study can be assumed to refer to rates calculated between the years 1985 and 1990, unless otherwise noted. The rates in this table are given for the years 1985 through 1990.

system market has been targeted so heavily by manufacturers and vendors that it offers little potential for continued replacement activity.

- The under-100-stations-per-system market should see strong growth. However, since PBX products will continue to compete with hybrid key systems in this market through 1990, the high growth expected for the whole segment will be shared by both types of equipment.
- The average number of PBX stations per new system shipped—having grown steadily since 1982, due to PBXs displacing very large Centrex installations—will continue rising, from 153 stations per new system shipped in 1985 to about 156 in 1987. After 1987 the average number of PBX stations per new system shipped will decline slowly, to about 153 stations per system, through the end of the decade. This rise-and-fall pattern will result both from leveling-off in the replacement of large Centrex installations through 1987 and from renewed Centrex growth at the high end around 1988.

Analog vs. Digital Systems

- Manufacturers' shipments of analog, space-division PBX equipment represented 10.7 percent of total PBX stations shipped in 1985, down from 17.3 percent in 1984.
- The analog share of PBX shipments will decline rapidly, to about 3 percent of total PBX shipments by 1990.
- Digital, time-division PBXs, though constituting the bulk of new PBX shipments in 1985, accounted for only about 40 percent of the PBX installed base that year.
- Digital PBXs will make up between 80 and 90 percent of the PBX installed base by 1990.
- End-user demand for PBX data-lines (extensions dedicated to data transmission within an integrated voice-data PBX system) has been slower to develop than some early projections indicated.
- PBX data-lines made up between 4 and 5 percent of total PBX stations shipped in 1985. PBX data-line shipments will grow by a 20 to 25 percent CAGR through 1990 but will amount to no more than 9 or 10 percent of total PBX stations shipped annually.

Centrex

The number of Centrex stations in use continues to grow, particularly in the lower line-sizes, cutting into potential growth rates for both PBX and hybrid key shipments.

- The base of Centrex stations will to grow at a 3.3 percent CAGR, from 7.9 million stations in 1985 to 9.3 million stations in 1990.
- New Centrex installations will increase at a 10.5 percent CAGR, from 825,000 stations in 1985 to 1.4 million in 1990.

Centrex rate reductions, feature enhancements, and restructured tariff offerings have rendered the service price- and feature-competitive with comparable PBX products in most geographic areas.

- Centrex is growing fastest in the small-line-size (under 100 stations per system) market.
- Net Centrex installed-line defections in the large (over 1,000 stations per system) line-size market have slowed and are expected to level off by 1987.
- After 1988 Centrex will begin to recapture market share from PBXs in the higher line-sizes. The BOCs, in promoting Centrex as a "gateway" to Integrated Services Digital Network (ISDN) services, are positioning Centrex as the preeminent "high-tech" offering for the 1990s.

Pay Telephone Market

The fledgling private-payphone industry—created by FCC fiat in June 1984—has yet to gain a significant share of a market once monopolized by telco-owned pay instruments. Current installed-base estimates reported in the press peg the number of privately owned pay telephones between 25,000 to 50,000, compared with close to 1.7 million installed telco-owned paysets. (See Tables XII and XIII, "Pay Telephone Access Line by Telco" and "Pay Telephone Installed Base by State." Though the numbers of installed private payphones continue to rise, prospects for accelerated growth in this market remain clouded by onerous state regulations, intensified competition from telcos, and slow public acceptance of high-tech phone features. These obstacles notwithstanding, droves of new manufacturers and vendors continue to enter the market to tap the approximately $4 billion in revenues generated annually from payphone service. Still, this high rate of entry into the private-payphone industry—even under the most optimistic of market outlooks—virtually guarantees a shakeout of many marginal manufacturers and vendors within the next few years.

Over the past two years, a majority of states—following the FCC's lead in permitting private payphones within that commission's interstate jurisdiction—have approved, with various conditions, the installation of private payphones within their intrastate bailiwicks. (See Table XII for state-by-state regulatory comparisons.) Of the handful of states that have yet to approve private payphones for intrastate calling, most have studies in the works or decisions pending—although Alaska has declined to consider the matter and

Table XI

STATE REGULATIONS ON PRIVATELY OWNED PAY TELEPHONES (COCOTs) AS OF MAY 1986

State	Intrastate COCOTs Legal?	Pass-Through of Directory Assistance Charges Permitted?	Location Restrictions?	Limitations on Call Duration?	Multi-Coin Required?
AL	y	$0.25	n	3 minutes minimum	y
AK	n				
AZ	y	NRS	y	NRS	NRS
AR	n,p				
CA	y	n	n	15 minutes minimum	n
CO	y	y	n	NRS	NRS
CT	n,p				
DE	y	NRS	n	3 minutes minimum	n
DC	y	NP	y	NP	y
FL	y	Toll only	n	NP	NRS
GA	y	NP	n	NP	NRS
HI	n,p				
ID	y	NP	n	y	y
IL	y	NRS	y	y, if additional coin deposit	n
IN	y	NP	y	NP	n
IA	y	y	d	d	d
KS	y	NP	n	NP	y
KY	y	y	n	NRS	y
LA	y	NP	n	y	n
ME	n,p				
MD	n,p				
MA	n,p				
MI	y	NRS	n	n	n
MN	y	NP	n	NP	NRS
MS	y	NP	n	3 minutes minimum	NRS
MO	y	y	n	NP	n
MT	y	d	n	d	d

Table XI

State	Intrastate COCOTs Legal?	Pass-Through of Directory Assistance Charges Permitted?	Location Restrictions?	Limitations on Call Duration?	Multi-Coin Required?
NE	y	y	n	NRS	NRS
NV	y	NC	n	y	y
NH	y	NRS	y	NP	NRS
NJ	y	NP	y	4 minutes minimum	y
NM	y	NRS	n	NRS	y
NY	y	y	n	NRS	n
NC	y	NP	n	NP	y
ND	y	y	n	NP	n
OH	y	NC	n	NRS	y*
OK	n				
OR	y	y	n	y	n
PA	y	y	n	3 minutes minimum	n
RI	y	y**	n	NRS	y
SC	y	NC	n	NP	y
SD	y	y	n	NRS	NRS
TN	y	NC	n	NP	y
TX	y	up to $0.30	n	NRS	NRS
UT	y	y	n	d	n
VT	y	n	n	y	y
VA	y	$0.25	n	NRS	y
WA	y	y	n	d	y
WV	n,p				
WI	y	NP	n	NP	y
WY	y	y	n	y	y

y = yes n = no p = pending before state PUC or state court NRS = no restriction specified

d = deregulated for COCOTs NP = not permitted NC = no charge

* public phones only ** only if directory not available

Multicoin requirement refers to state rules mandating private-payphone ability to accept more than one denomination of coin.

COCOT: Privately owned pay telephone.

Source: *Payphone Magazine Reference Guide.*
Courtesy of U.S. PayPhone Inc., P.O. Box 42371, Houston, TX 77042.
Regulatory information dated May 1986.

Table XII

PAY TELEPHONE ACCESS LINES BY TELCO: 1980–1985

	Number of Public Telephone Access Lines					
TYPE OF TELCO	1980	1981	1982	1983	1984	1985
Bell	1,666,344	1,637,747	1,706,974	1,679,487	1,545,351	1,511,528
Independent	232,080	246,223	250,943	251,554	258,150	262,503
TOTAL	1,898,424	1,883,970	1,957,917	1,931,041	1,803,501	1,774,031

Sources: FCC, USTA

Note: Bell figures include Southern New England Telephone and Cincinnati Bell for all years.

Oklahoma has even refused intrastate connection outright. However, even in many states that allow intrastate connections, regulators have set rates on telco-provided private-payphone lines at levels that often render operation of private paysets unprofitable. Moreover, widely varying state regulations on locations, physical dimensions, capabilities, appearances, and other features of private paysets lessen the attractiveness of doing business in this young field.

Single-Line Telephone Market

Unit sales of single-line consumer phones will remain flat over the next few years but will continue along a plateau significantly higher than before 1982, when, as a result of media attention to divestiture and deregulation, many residential and small-business users began to purchase rather than rent their phones. The single-line telephone market has yet to recover fully from its slump in 1985, when it experienced a sharp decline in unit sales following two years of unprecedented growth. Margins for manufacturers and suppliers in this largely retail market will remain very narrow, the result of sluggish demand, oversupply, and a commodity-like product orientation. The bulk of new sales will be for replacements of existing sets. Back in favor are basic, traditional-looking sets, generally sporting only a few enhanced calling features.

Bright spots for the single-line phone market are in sales of cellular sets and answering machines, which will continue growing strongly, though declining prices will depress profit margins for industry firms.

A potentially significant trend in the single-line telephone market is the growing number of specialized phone-retail outlets targeted at small-business users, who traditionally have accounted for a substantial portion of the demand for single-line sets. The market has yet to determine which, if any, of these retailers can prosper by retailing single-line sets alongside key and other business phone systems that traditionally have been sold through direct-sales channels.

Table XIII

PAY TELEPHONE INSTALLED BASE STATE-BY-STATE

State	Number of Installed Payphones		State	Number of Installed Payphones	
	Telco	Privately Owned		Telco	Privately Owned
Alabama	20,000	N/A	Montana	5,095	231
Alaska	1,284	0	Nebraska	7,000	N/A
Arizona	20,590	603	Nevada	6,000	N/A
Arkansas	13,000	0	New Hampshire	8,500	45
California	173,000	200	New Jersey	75,000	828
Colorado	23,460	558	New Mexico	6,953	328
Connecticut	25,500	N/A	New York	170,000	7,000
Delaware	4,667	N/A	North Carolina	20,084	96
DC	10,214	N/A	North Dakota	4,000	N/A
Florida	63,334	688	Ohio	70,000	825
Georgia	35,660	1,600	Oklahoma	22,000	0
Hawaii	6,500	0	Oregon	13,000	0
Idaho	3,756	100	Pennsylvania	70,000	2,358
Illinois	77,000	3,800	Rhode Island	10,000	N/A
Indiana	24,000	N/A	South Carolina	16,072	106
Iowa	14,000	N/A	South Dakota	4,500	12
Kansas	17,000	61	Tennessee	28,000	1,000
Kentucky	16,000	540	Texas	124,000	4,000
Louisiana	29,000	282	Utah	8,242	89
Maine	6,000	0	Vermont	3,000	N/A
Maryland	34,416	0	Virginia	33,434	306
Massachusetts	55,000	0	Washington	22,000	N/A
Michigan	62,000	1,050	West Virginia	8,722	0
Minnesota	16,000	N/A	Wisconsin	26,000	100
Mississippi	17,000	147	Wyoming	4,048	N/A
Missouri	33,000	60			
			TOTAL	1,567,031	27,013

Source: *Payphone Magazine Reference Guide*, courtesy of U.S. Payphone, Inc., P.O. Box 42371, Houston, TX 77042.

Figures compiled between December 1985 and March 1986.
N/A—information not available.
Note: Telco figures range from 1984 to 1986, and should be assumed to refer only to Bell company installed base, except for Arkansas, Georgia, Illinois, and Iowa figures, which cover all telcos in those states.

Table XIV

MANUFACTURERS' SHIPMENTS OF SINGLE-LINE TELEPHONE EQUIPMENT: 1985 & 1986

Product	Units (Thousands)		$Value (Millions)		Avg. Value ($ per Unit)	
	1985	1986	1985	1986	1985	1986
Corded Telephones	22,000	21,000	$690	$630	$ 31	$ 30
Cordless Telephones	4,000	4,100	$280	$280	$ 70	$ 68
Cellular Telephones	75	150	$115	$185	$1,550	$1,250
Answerers	3,600	4,100	$266	$300	$ 74	$ 73

Source: Electronic Industries Association

Value at factory level. 1986 figures are projected.

VENDOR MARKETS

Summary

Business-equipment vendor markets currently are experiencing both a rapid consolidation of equipment dealers and a long-term shift in distribution patterns. The long-expected shakeout of marginal vendors, which began in earnest in 1985, is expected to last at least through 1987, and possibly longer. Although the current attrition—coming through mergers and acquisitions, as well as business failures—will reduce the number of industry participants by the end of the decade, those firms remaining in the market will realize higher sales volumes and improved profit margins.

A long-term shift in distribution patterns favors AT&T and the BOCs at the expense of both interconnects and independent telephone companies. Current predictions call for AT&T and the BOCs to account for over 55 percent of all new equipment sales annually by 1990—up from a combined share of 38 percent in 1985—while the combined share of interconnects and independent telephone companies will decline over the same period.

- AT&T, despite chronic organizational and marketing problems, will increase its market share of annual business-telecommunications-equipment sales from 27.3 percent in 1985 to 28.2 percent in 1990.

- The BOCs as a group will increase their share of new annual equipment sales from 10.8 percent in 1985 to 27 percent in 1990, although performance will vary between the various Bell companies.

- The independent telephone operating companies, hampered by their concentration in predominantly nonurban market areas, will see their share of annual new equipment sales slip from 9.5 percent in 1985 to 8.1 percent in 1990.

- Interconnect vendors, the sector of the market hit hardest by postdivestiture developments, will see their aggregate share of annual new equipment sales drop from 52.4 percent in 1985 to 36.7 percent in 1990.

- Despite the loss of market share predicted for interconnects as a group, many individual vendors will realize higher sales volumes and improved profit margins in the more concentrated market of the late-1980s.

AT&T

Although AT&T's 100-year reputation for service and technological expertise assists its continuing dominance in the equipment market, the telecom giant seems to be struggling to develop an effective approach to marketing phone gear in a deregulated environment. Over the past two years, AT&T's marketing efforts have suffered from lack of a clearly defined marketing strategy, as evidenced by repeated corporate reorganizations.

- AT&T has led the price competition and has been hit hard by the resulting erosion in profit margins, with losses from computer and telecommunications equipment estimated at close to $1 billion in 1985.

- Even after AT&T's massive campaign to retain "embedded-base" customers (those whose equipment contracts with the BOCs were transferred to AT&T at divestiture), the telecom giant's revenues from equipment rentals have been shrinking at an estimated 20 percent annually since 1984.

- Despite these setbacks and chronic marketing problems, AT&T is expected to see some improvement in its share of annual new equipment sales, with a projected rise from 27.3 percent in 1985 to 28.2 percent in 1990.

Bell Operating Companies

Despite a slower-than-anticipated start in 1984, the BOCs have fulfilled expectations that they would soon become major players in the telephone equipment market. While the individual BOCs' performances have been mixed, as a group they have achieved steady and solid gains in market share in both the PBX and key markets.

- Although some of the BOCs' competitors maintain that the Bells have yet to develop a coherent and

Table XV

TOTAL BUSINESS TELEPHONE EQUIPMENT SALES BY VENDOR CATEGORY: 1985 & 1990

	1985		1990	
	Sales ($ Mill.)	% Share	Sales ($ Mill.)	% Share
Interconnect Vendors	$2,634	52.4%	$2,380	36.7%
AT&T	$1,381	27.3%	$1,831	28.2%
Bell Operating Companies	$ 539	10.8%	$1,715	27.0%
Independent Operating Companies	$ 483	9.5%	$ 518	8.1%
TOTAL	$5,037	100%	$6,444	100%

Source: NATA

Figures are for combined sales of PBX, key, and hybrid equipment at the end-user level.

consistent approach to pricing, most observers report that the BOCs have formulated a strategy of attempting to "buy" market share, particularly in the PBX market, through low prices.

- Observers also report that most of the BOCs are pursuing a "Centrex first" strategy in the large-system market, in which they initially propose Centrex service to users but follow up with a PBX bid if the Centrex proposal is rejected.

- The BOCs are expected to show continued growth in equipment sales, jumping from 10.8 percent of annual new CPE sales in 1985 to 27 percent by 1990.

Independent Telephone Operating Companies

Many independent telephone operating companies seem to be reevaluating their commitments to the business-telephone-equipment market and are scaling back their marketing efforts. The independents may be at a geographic disadvantage because their operating regions are concentrated primarily outside the major urban markets—although, like everyone else in the market, they have been hurt by the recent price wars and concomitant drop in the profitability of equipment sales.

- The independent operating companies' share of new PBX and key system sales will drop from 9.5 percent in 1985 to about 8.1 percent in 1990.

Interconnect Market

The interconnect industry has entered a period of retrenchment and market consolidation following the twin market shocks of deregulation and the AT&T divestiture.

- Total interconnect industry revenues are expected to remain essentially flat through 1990—increasing at only a 0.9 percent CAGR to $4,111 million—with interconnects accounting for a decreasing share of total annual business-CPE sales through 1990, and their actual sales volumes declining as well.

- Offsetting interconnects' declining new systems sales, to some extent, will be a steady increase in revenues from post-sales activities—primarily moves-adds-and-changes, maintenance, and the sale of peripheral equipment to existing customers.

The number of interconnect companies is decreasing.

The tremendous influx of new vendors into the market in 1983 and 1984 turned into an exodus in 1985 and 1986 as the pace of company failures and acquisitions quickened.

- This shakeout of marginal companies is expected to continue at least through 1987 and the multiline business-CPE market is expected to become much more concentrated by the end of the decade.

- The shakeout of marginal interconnects and consolidation of healthier ones will lead to an easing of the sustained price competition that has been plaguing the industry since 1984—and to a corresponding increase in aggregate profit margins.

- Consolidation will also lead to higher average sales volumes on a per-company basis, providing successful companies with both increased sales and fatter profit margins by the end of the 1980s.

- The much-discussed merging of telecommunications and data-processing technologies is reaching the marketplace, bringing with it opportunities for interconnects to supplement their traditional key and PBX product lines with new types of office-automation solutions.

New System Sales

Table XVI details interconnect sales and revenue projections through 1990.

- Interconnect industry revenues from the sale of new PBX, key, and hybrid systems declined to $2,634 million in 1985, an 11.04 percent drop from 1984 levels.*

- Interconnects' new system sales revenues are projected to continue declining, at a 2 percent CAGR, 1985-1990, as interconnects lose market share to other vendors, particularly to the BOCs.

- The percentage of sales costs accounted for by these various charges differs considerably between different types of equipment—and from one company to another—but, as a rough industry average, equipment hardware accounts for 75 to 80 percent of new system charges, installation labor another 15 to 25 percent, and warranty charges between 1 and 6 percent.

Post-Sales Revenues

- Interconnects' revenues from post-system-sale activities—including moves-adds-changes, maintenance, and sales of peripheral and expansion equipment to existing customers—rose 6.4 percent in 1985, to $1,297 million.

- Post-sales revenues will grow at a 5.9 percent CAGR through 1990, increasing from 33 percent of total revenues in 1985 to about 42 percent in 1990.

- The bulk of post-sales revenues—like sales revenues—comes from hardware charges, with line and trunk cards, application processors, and other peripheral equipment accounting for an estimated 67 percent of total charges and labor accounting for the remaining 33 percent.

Market Strategies

In the early 1980s, the interconnect industry moved from a period of high growth to one of cooled-down expansion, a sea change that transformed vendors from risk-oriented entrepreneurs to cost-conscious profit maximizers. In the face of declining sales volumes and slimmer profit margins, most interconnects have begun developing new strategies for survival.

Cost-control strategies have pervaded every aspect of the average interconnect's operations, from inventory management and revised cost-accounting methods to new sales and marketing approaches.

- One of the more popular of these cost-related measures has been the banding together of independent equipment vendors into various types of purchasing and marketing consortia. These combinations generally provide participating vendors with

*Interconnects' revenues from new system sales consist of charges for equipment hardware, installation labor, and warranties (typically one-year warranty contracts).

Table XVI

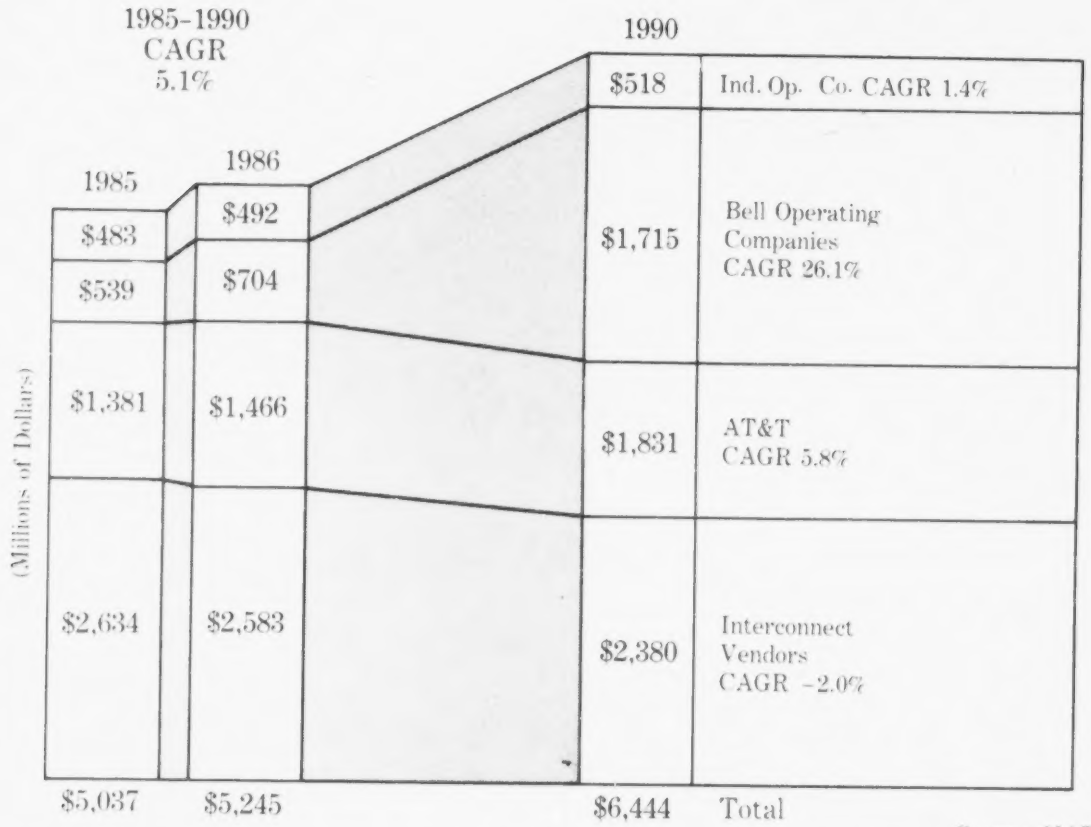
INTERCONNECT INDUSTRY ESTIMATED SALES AND REVENUES: 1984–1990

	Stations (000)	Sales ($ Mill.)	Other ($ Mill.)	Total Revenue ($ Mill.)
1984				
PBX	2,134	$1,654		
Key & Hybrid	2,377	$1,307		
TOTAL		$2,961	$1,219	$4,180
1985				
PBX	2,130	$1,544		
Key & Hybrid	2,202	$1,090		
TOTAL		$2,634	$1,297	$3,931
1986				
PBX	2,127	$1,542		
Key & Hybrid	2,081	$1,041		
TOTAL		$2,583	$1,391	$3,974
1987				
PBX	2,130	$1,566		
Key & Hybrid	1,960	$ 990		
TOTAL		$2,556	$1,469	$4,025
1988				
PBX	2,113	$1,585		
Key & Hybrid	1,822	$ 929		
TOTAL		$2,514	$1,561	$4,075
1989				
PBX	2,048	$1,567		
Key & Hybrid	1,677	$ 864		
TOTAL		$2,431	$1,655	$4,086
1990				
PBX	2,044	$1,573		
Key & Hybrid	1,567	$ 807		
TOTAL		$2,380	$1,731	$4,111

Source: NATA

These figures show annual sales and service revenues for interconnect vendors at the end-user level. The figures are not cumulative through the different years. Figures for key and hybrid stations include estimates for stand-alone installations and for "adjunct" equipment installed behind PBX systems or Centrex service. "Other" revenues are generated by service offerings, lease contracts, and secondary sales to established customers. Figures represent industry averages, and actual prices-per-line and revenue ratios vary from company to company.

TOTAL BUSINESS TELEPHONE EQUIPMENT SALES BY VENDOR CATEGORY



Source: NATA

greater purchasing power, better manufacturer support, and higher visibility in the marketplace than any member can attain on his own.

- Other recent cost-control innovations include the use of centralized telemarketing campaigns to generate sales leads and the development of retail outlets as lower-cost alternatives to traditional sales calls on small-business customers.

Another type of market strategy, product-line expansion, has enabled an increasing number of established interconnects to position themselves in the more broadly defined office-automation market. In addition to selling traditional voice-oriented application processors and peripherals, interconnects are actively marketing local-area networks, modems, and personal computers—not to mention selling Centrex services as authorized agents for local telcos. Most interconnects report very favorable profit margins and relatively low start-up costs associated with these types of products relative to voice-only equipment.

ACCESS LINES

Table XVII

SUBSCRIBER ACCESS LINES BY TYPE OF SERVICE: 1985

	Lines (000)
RBOCs	
Main Telephones	
Residential	68,862.3
Business	16,727.5
PBX Trunks including Centrex	6,862.0
Public Telephones	1,451.6
Public Mobile	41.3
TOTAL	93,944.7
Independent Telephone Companies	
Main Telephones	
Residential	18,841.9
Business	3,514.5
PBX Trunks including Centrex	787.6
Public Telephones	262.5
Public Mobile	23.5
TOTAL	23,430.0
TOTAL SUBSCRIBER ACCESS LINES	117,374.7

Source: USTA

SUBSCRIBER ACCESS-LINE CATEGORY DEFINITIONS

A *main access line* is a line from a customer station-set to a telephone central-office switch, including WATS lines but not including lines connected to Centrex.

A *PBX or Centrex access line* is a line from a PBX, key system, or hybrid system to a telephone central office, or a line from a Centrex station set to the central office.

An *other switched access line* is a line to a telephone central office switch, other than a main, WATS, PBX, Centrex, key-system, or hybrid-system access line. This category—essentially a catch-all for those lines telcos fail to classify—consists largely of lines from mobile-telephone switches to landline telephone central-offices.

A *special access line* is a dedicated line from a customer main station, switch, or other point of traffic concentration to an interexchange carrier's switch or point of presence, but not including lines connecting customer main stations to customer switches. This category includes only those lines in a local private network that provide access to an interexchange facility. A single T1—or other wideband—circuit is counted only once, regardless of how many 64 kb/s transmission modules it holds.

Table XVIII

SUBSCRIBER ACCESS LINES BY STATE: 1985

State or Other Area	TYPE OF ACCESS LINE					TYPE OF CUSTOMER		
	Total	Main	PBX & Centrex	Other Switched	Special	Business	Coin	Residence
ALABAMA	1,389,959	1,299,136	66,297	21,187	3,339	279,189	21,863	1,088,907
ALASKA	133,452	115,524	0	0	17,928	56,024	1,453	75,975
ARIZONA	1,520,105	1,392,898	78,319	23,854	25,034	414,745	20,604	1,084,756
ARKANSAS	726,401	676,359	26,712	11,147	12,183	166,627	14,143	545,631
CALIFORNIA	14,392,867	12,542,285	1,794,163	36,274	20,145	4,535,423	213,695	9,643,749
COLORADO	1,710,260	1,574,061	79,457	32,245	24,497	505,636	23,761	1,180,863
CONNECTICUT	1,707,815	1,465,203	119,068	123,544	0	465,754	24,645	1,217,416
DELAWARE	342,375	283,258	47,025	7,204	4,888	104,111	4,690	233,574
DIST. OF COLUMBIA	864,346	406,862	358,969	19,232	79,283	568,839	10,266	285,241
FLORIDA	5,918,383	5,534,200	263,569	80,782	39,832	1,392,224	91,246	4,434,913
GEORGIA	2,443,323	2,187,951	186,483	62,819	6,070	662,395	39,855	1,741,073
HAWAII	475,448	262,831	204,190	789	7,638	126,685	6,467	342,296
IDAHO	409,749	376,877	23,030	5,945	3,897	104,078	5,256	300,415
ILLINOIS	5,602,840	4,850,993	621,761	19,054	111,032	1,712,579	86,652	3,803,609
INDIANA	2,177,474	1,964,823	129,446	53,428	29,777	498,491	32,695	1,646,288
IOWA	1,045,649	931,442	70,207	23,711	20,289	263,165	13,424	769,060
KANSAS	988,465	891,514	66,211	14,829	15,911	264,810	17,396	706,259
KENTUCKY	1,267,743	1,185,054	60,587	13,386	8,716	263,669	20,317	983,757
LOUISIANA	1,752,195	1,609,085	107,847	25,331	9,932	404,943	28,211	1,319,041
MAINE	0	0	0	0	0	0	0	0
MARYLAND	466,716	445,308	21,408	0	0	88,067	6,785	371,864
MASSACHUSETTS	2,431,058	2,053,993	263,730	31,439	81,896	736,631	34,418	1,660,009
MICHIGAN	3,157,875	2,813,854	344,021	0	0	806,052	58,913	2,292,910
MINNESOTA	4,366,921	3,773,440	504,799	18,166	70,516	1,199,698	62,690	3,104,533
MISSISSIPPI	1,729,102	1,440,712	224,978	36,253	27,159	519,948	18,356	1,190,798
MISSOURI	855,776	805,616	36,210	9,772	4,178	175,065	14,870	665,841
MONTANA	2,113,254	1,914,972	124,572	30,326	43,384	531,147	36,619	1,545,488
NEBRASKA	309,139	297,605	3,640	6,421	1,473	72,080	5,443	231,616
NEVADA	690,095	611,185	53,311	15,087	10,512	176,583	9,041	504,471
NEW HAMPSHIRE	507,114	456,417	29,472	6,007	15,218	147,334	8,752	351,028
NEW JERSEY	488,023	445,257	42,766	0	0	113,197	7,992	366,834
NEW MEXICO	4,373,173	3,751,357	375,187	101,496	145,133	1,312,737	78,914	2,981,522
NEW YORK	554,170	512,174	28,031	7,839	6,126	145,169	7,497	401,504
NORTH CAROLINA	9,406,062	8,291,427	1,113,690	130	815	2,714,377	153,871	6,537,814
NORTH DAKOTA	2,317,293	2,094,277	164,249	49,695	9,072	522,305	30,712	1,764,276
OHIO	249,032	226,075	14,580	4,816	3,561	60,648	3,460	184,924
OKLAHOMA	4,632,261	4,172,580	312,173	87,299	60,209	1,089,260	68,751	3,474,250
OREGON	1,382,181	1,279,883	63,722	17,647	20,929	359,739	23,462	998,980
PENNSYLVANIA	1,176,985	1,032,327	104,242	20,976	19,440	326,279	16,175	834,531
RHODE ISLAND	5,364,032	4,686,839	486,672	99,059	91,462	1,424,151	73,252	3,866,629
SOUTH CAROLINA	465,782	440,140	25,642	0	0	91,227	7,978	366,577
SOUTH DAKOTA	1,022,598	943,513	61,475	14,751	2,859	226,362	17,720	778,516
TENNESSEE	242,067	222,713	11,229	5,124	3,001	55,577	3,875	182,615
TEXAS	1,904,847	1,736,119	126,053	31,650	11,025	430,955	27,899	1,445,993
UTAH	7,333,729	6,610,289	464,468	81,461	177,511	2,189,072	128,023	5,016,634
VERMONT	651,460	597,140	34,759	12,296	7,265	176,339	8,328	466,793
VIRGINIA	225,114	213,072	12,042	0	0	48,714	3,925	172,475
WASHINGTON	2,759,046	2,374,870	276,568	35,322	72,286	700,859	39,469	2,018,718
WEST VIRGINIA	2,093,013	1,800,135	236,452	29,093	27,333	599,035	26,924	1,467,054
WISCONSIN	707,863	652,116	34,735	7,322	13,690	142,965	9,369	555,529
WYOMING	1,885,928	1,674,854	158,382	29,395	23,297	456,558	25,319	1,404, 051
UNITED STATES	110,951,259	98,126,133	10,067,942	1,366,288	1,390,896	30,489,520	1,699,484	78,762,255

Preliminary data submitted to the FCC by reporting telephone carriers for the year ended December 31, 1985. Reported figures represent 95% of total U.S. access lines.

U.S. BALANCE OF TRADE IN TELEPHONES AND TELEPHONE SWITCHING EQUIPMENT

Market

While the overall U.S. balance of trade in high-technology goods continued to worsen in 1985, certain sectors of the telephone and telephone-switching-equipment markets improved somewhat, though they still showed a sizeable trade deficit. The U.S. trade deficit in telephones and telephone switching equipment fell 9 percent in 1985 to $1.2 billion, down from the $1.3 billion reported for 1984—the result partly of a steep drop in the dollar's value against other currencies. Imports fell 2 percent in 1985 from the previous year. Most of the 1985 drop in imports is a reflection of a 13 percent decline in U.S. demand for foreign-made telephone instruments and a 6 percent decrease in U.S. purchases of foreign-made switching equipment. The only import product category showing an increase for the year was "other telephone apparatus"—comprising answering machines as well as multiplexers, modems, and other voice- and data-transmission equipment—which was up 12 percent.

Total exports grew 11 percent across all categories of telephone equipment in 1985, though U.S. sales abroad of central-office and customer-premise switching equipment fell 9 percent during the year. Growth in exports was driven by quickening overseas demand for U.S. telephone instruments, answering machines, and voice- and data-transmission equipment.

Japan, by far the United States's largest trading partner in telephone gear, saw its share of the U.S. import market fall to 45 percent in 1985, a 1 percentage point drop from the previous year. Moreover, the import share of Japan's East Asian neighbor countries in 1985 also fell, declining 3 percentage points from the 1984 level. The European Economic Community (EEC) and Sweden registered large increases in import share, while Canada, Latin America, and Israel saw modest increases. The EEC showed by far the largest percentage jump in value of shipments sold, boosting its phone equipment sales to the United States by 119 percent, with Sweden's shipment value growing 52 percent, Canada's 16 percent, and Israel's 12 percent. However, Japan saw a 5 percent decline and the rest of the Far East, a 13 percent fall in value of shipments.

Public Policy/Regulatory

Over a half-dozen trade bills were introduced in Congress over the past two years, many calling for the president to retaliate against some foreign governments' unfair trading practices should those nations refuse to open their markets to U.S. telecommunications products and services. None of these measures passed into law before Congress adjourned for elections, and at this writing, a lame-duck session appears unlikely. Most of these trade bills were aimed at enhancing access for U.S. manufacturers to offshore markets. NATA and other analysts, however, have questioned whether closing the U.S. market would have that effect. Exports would be slow to improve, say these analysts, because few U.S. manufacturers have indicated any incentive to invest in sales and technical support needed to penetrate Japanese and other foreign markets more deeply, particularly if the dollar continues its fall in value. Protectionist moves—such as raised tariffs and tightened quotas—would likely have greatest impact on the many independent CPE vendors in the United States who market foreign-made products.

Table XIX

U.S. BALANCE OF TRADE IN TELEPHONE AND TELEPHONE SWITCHING EQUIPMENT: 1985

($000)

	Switching and Switchboard Equipment	Telephone Instruments	Other Telephone Apparatus	TOTAL
Imports				
Japan	$201,982	$209,275	$446,261	$857,518
Canada	215,494	24,939	66,436	306,869
EEC*	19,989	26,577	16,768	63,334
Sweden	18,087	404	10,043	28,534
Latin America	9,191	3,111	21,461	33,763
Israel	8,710	3	18,645	27,358
Far East (exc. Japan)	44,093	385,425	155,401	584,919
Other	1,385	157	4,374	5,916
TOTAL	$518,931	$649,891	$739,389	$1,908,211
Exports				
Japan	$ 15,132	$ 4,363	$ 19,394	$ 38,889
Canada	49,721	5,689	39,656	95,066
EEC*	102,698	4,399	66,107	173,204
Sweden	1,318	123	3,842	5,283
Latin America	38,838	11,467	62,908	113,213
Israel	20,116	311	4,231	24,658
Far East (exc. Japan)	92,523	6,774	86,006	185,303
Other	42,327	4,196	31,681	78,204
TOTAL	$362,673	$37,322	$313,825	$713,820

Source: EIA and U.S. Department of Commerce

*EEC: The European Economic Community consists of Denmark, The United Kingdom, Ireland, The Netherlands, Belgium, Luxembourg, France, West Germany, Spain, Portugal, Italy, and Greece.

GLOSSARY

Access Lines—Any circuit from the telephone company's central office to a customer's premises. Also known as local loops.

Adjunct-Key System—A key telephone system installed behind a PBX system or to Centrex lines providing users with enhanced feature access and greater ease of use than standard single-line telephone sets.

AT&T—American Telephone and Telegraph Company. Prior to its court-ordered divestiture in 1984, AT&T was the parent of the Bell operating companies and is now the parent company of AT&T Network Operations Group, which operates the largest U.S. long-distance network (formerly known as AT&T Communications and, before that, Long Lines); AT&T Business Markets Group, which markets network services and telecommunications/computer equipment to large businesses; AT&T General Markets Group, which markets network services and telecommunications/computer equipment to small businesses and consumers, and manages the whole corporation's manufacturing operations (formerly known as Western Electric); and Special Markets Group, which manages AT&T's joint ventures and partnerships with other companies.

Bell Operating Company (BOC)—One of 22 Bell telephone companies whose primary business is providing local telephone service to customers. A BOC may market, but not manufacture, new equipment. (Note: In the *NATA Statistical Review*, "BOC" is used to refer generically to all Bell companies, including equipment sales subsidiaries, whether the subsidiary is administered by a Bell regional holding company or an individual Bell operating company.)

Business Telephone Instruments—All telephones located on business premises, including single-line installations as well as phone sets associated with Centrex, PBX, and key systems.

CAGR—Compound annual growth rate. (Note: In the *NATA Statistical Review*, CAGR is given for the years 1985 through 1990, unless otherwise indicated in the text.)

Centrex—A business switching service, provided exclusively by local operating companies using monopoly, central-office switching equipment and outside plant as an alternative to PBX service.

CPE—See Customer Premises Equipment.

Customer Premises Equipment (CPE)—Any apparatus—including telephone handsets, PBX switching equipment, key and hybrid telephone systems, and add-on devices—which is physically located on the customer's property, as opposed to the telephone company's central office.

Electromechanical Equipment—Equipment that incorporates mechanical switches and relays rather than solid-state microprocessor "chips."

Electronic Equipment—Equipment that incorporates solid-state microprocessor "chips" in place of mechanical switches and relays.

Embedded Base—All Bell-supplied equipment in-place on customers' premises as of January 1, 1983. This equipment was transferred from the Bell operating companies to AT&T at the time of divestiture.

FCC—Federal Communications Commission. An independent federal agency authorized by the Communications Act of 1934, responsible for regulating interstate and foreign telecommunications.

Hybrid Telephone System—A multiline telephone system that can combine the network-access characteristics of both traditional key systems and PBX systems.

Independent Telcos—Any of the approximately 1,400 local telephone operating companies not affiliated with the predivestiture Bell system.

Installed Base—Telephone equipment currently installed and in use.

Interconnect Companies—The approximately 3,000–4,000 nontelco suppliers of business telephone instruments.

Key Telephone System (KTS)—A multiline telephone system designed to provide shared access to several outside lines through buttons, or keys, on the handset, typically offering identified access lines with direct line-appearances or terminations on a given station set.

KTS—See Key Telephone System.

LAN—See Local Area Network.

Local Area Network (LAN)—A high-speed data communications system with all aspects of the transmission medium controlled by a network operator. LANs typically permit the user to connect several diverse telecommunications and office-equipment functions into an integrated system.

OEM—See Original Equipment Manufacturer.

One-A-2 (1A2)—A generic term referring to an early, sparsely featured, electromechanical key system.

Original Equipment Manufacturer (OEM)—Company that manufactures equipment (such as PBX systems) from components usually bought from other manufacturers.

PBX—See Private Branch Exchange.

Private Branch Exchange (PBX)—A private telephone switching system located on a customer's premises. Both PBX and hybrid PBX systems provide pooled access to a group of access lines, typically by dialing "9" from an internal station set.

Regional Holding Company (RHC)—One of seven firms created from the AT&T divestiture, each of which acts as a holding company within a region of the United States for one or more of the 22 divested Bell operating companies, as well as for their unregulated subsidiaries.

Retail Market—The distribution channel—comprising such outlets as department stores, mail-order catalogs, and household electronic shops—through which single-line telephones and key telephone systems are commonly marketed.

RHC—See Regional Holding Company.

Single-Line Installation—A business telephone instrument providing direct access to the telephone network and not connected to a Centrex, PBX, or key system.

Stand-Alone—A key system directly connected to the telephone network, as opposed to one connected to a PBX or Centrex system.

Station—A telephone set connected directly to an outside line or an internal PBX line with its own discrete number. This study measures stations roughly in terms of lines actually in use, not in terms of a system's capacity.

Stored-Program Control—A type of switching system in which all system operations and features are controlled by computer programs.

System—An entire PBX, key, or Centrex installation, including all individual telephone instruments, wire, cable, and common equipment (such as the switch for PBX and the main distribution frame for a key telephone system).

Telco—A common abbreviation for a local telephone operating company.

Telephone Operating Company—A regulated company whose primary business is providing local telephone service to customers.

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